

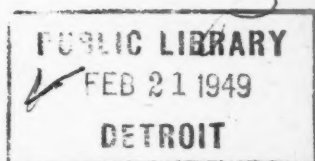
TECHNOLOGY DEPARTMENT

THE JOURNAL OF THE INSTITUTION OF PRODUCTION ENGINEERS

VOL. XXVIII

No. 2

February, 1949



Contents :

MEASUREMENT OF PRODUCTION EFFICIENCY
ONE DAY CONFERENCE

MEMORANDUM ON METHODS EMPLOYED TO
ACHIEVE ECONOMY IN THE USE OF FUEL

BALL AND ROLLER BEARINGS
by J. E. BATY, M.I.P.E.

ALUMINIUM ALLOY GRAVITY DIE CASTINGS
AS AFFECTING THE PRODUCTION ENGINEER
by H. C. CROSS.

Published by THE INSTITUTION,
36, PORTMAN SQUARE, LONDON, W.1
All rights reserved.

Telephone :
WELbeck 6813/7.
PRICE 5/-

TRIEFUS

INDUSTRIAL DIAMONDS

For
Wheel dressing
Wire drawing
Drilling, engraving &
all mechanical purposes

*Diamond Boart
& Diamond Powder
(Graded and Purified)*

TRIEFUS & CO., LTD.

32-34 HOLBORN VIADUCT · LONDON · E.C.1

Phone: CENTRAL 9923-4 · Grams: TRIEFUS LONDON

**NEW YORK · PARIS · TORONTO
SYDNEY · WELLINGTON
GEORGETOWN, B.G. · ANTWERP · RIO DE JANEIRO**

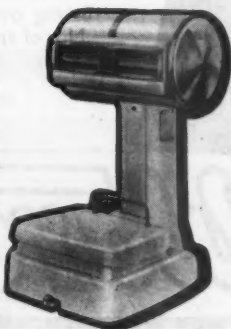


HOW 'BIRMAL' HELPS

IN THE PRODUCTION OF THE "Swift" 20LB. CYLINDER SCALE.

Here are three castings of which our customer says "In the production of an instrument where delicacy of balance and infinite accuracy are essential, the highest quality aluminium castings must be used. We appreciate the way your staff has taken infinite pains in studying the problems involved and in meeting our specialised requirements." More and more our friends are realising the advantages of buying their castings *en suite*, thus ensuring uniform quality in specification alloys and matched deliveries coupled with the personal interest of all our employees.

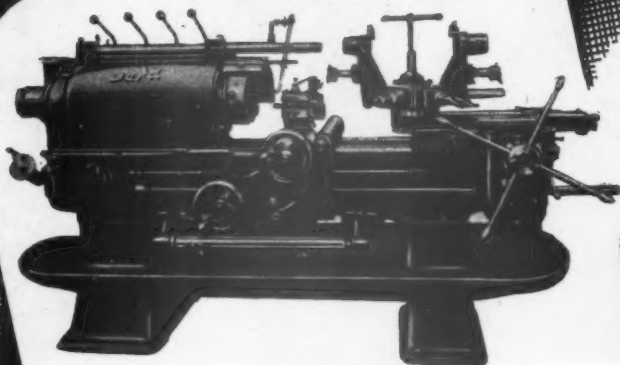
BIRMINGHAM ALUMINIUM CASTING (1903) CO LTD
BIRMID WORKS · SMETHWICK · BIRMINGHAM 40



NEWCASTLE & GOSWOLD ROAD, BIRMINGHAM 40

★ THE **Ward** N°7 CAPSTAN LATHE

WITH
COVERED BED



Height of centre	...	...	8½ in.
Dia. of hole through spindle	...	...	2½ in.
Swing over bed covers	...	...	16½ in.
No. of spindle speeds forward & reverse	...	...	8
Range of spindle speeds	...	...	26 to 1,000 r.p.m.

Further details on request.

Ward

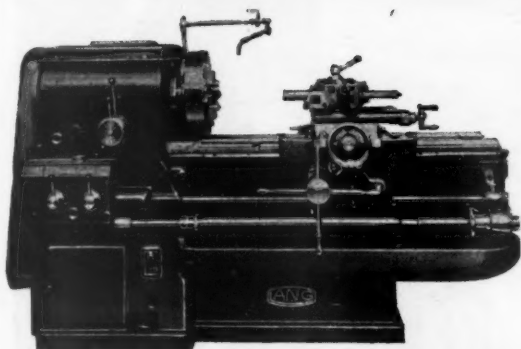
CAPSTAN & TURRET LATHES



H. W. WARD & CO. LTD. Dale Road Birmingham. 29



VALUED
WHEREVER LATHES
ARE NEEDED BY EXECUTIVES
WHO SPEND MONEY WISELY
AND BY SKILLED MECHANICS
WHOSE PRIDE IS IN THEIR WORK



**17" SWING 'JUNIOR'
SURFACING & BORING
LATHE**

FOR 'ONE OFF' OR
BATCH PRODUCTION—
AN IDEAL LATHE IN
EITHER CASE

Twelve speeds: Hardened
nickel-chrome gears:
Patent preloaded spherical
roller bearing for spindle:
Quick release chuck: Pro-
tected bed, 200 Brinell: Six
feeds: Convenient controls.

JOHN LANG & SONS LTD

JOHNSTONE · NEAR · GLASGOW

Phone: JOHNSTONE 400

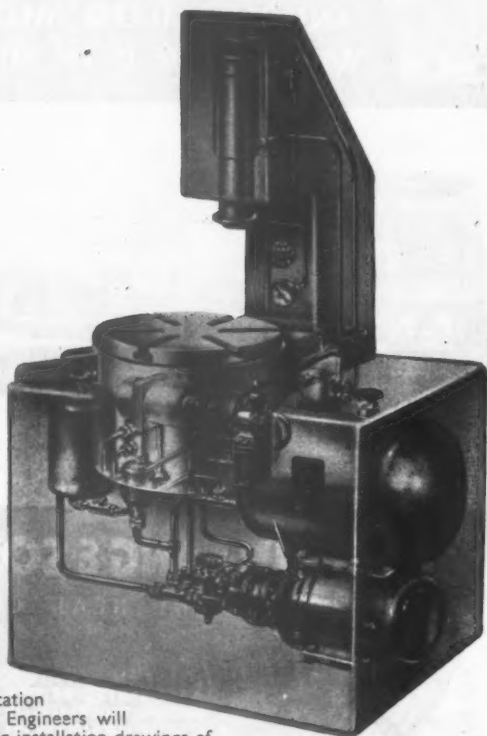
LONDON OFFICE:
ASSOCIATED BRITISH
MACHINE TOOL MAKERS LTD.
17 GROSVENOR GARDENS SW1.



Keelavite *Hydraulics*

**V.S. DRIVES for
MACHINE TOOLS
PRESS TOOLS
FORGING, STAMPING
WELDING, MOULDING
MECHANICAL HANDLING
MACHINES and for
FOUNDRY EQUIPMENT
ROAD - MAKING
MINING, TENSION
CONTROL EQUIPMENT
TEXTILE, BAKERY
& PAPER MAKING
MACHINERY •**

Hydraulic circuits can be designed and built up from standard Keelavite pumps motors, valves etc., to solve any problem of power distribution particularly when varying speed, varying load, frequent reversal or movements in sequence are important factors. Given detailed information relating to the proposed application of hydraulic power, Keelavite Engineers will put forward proposals, including installation drawings of the units concerned, hydraulic circuit, and any necessary electric control unit.



KEELAVITE ROTARY PUMPS & MOTORS LTD. ALLESLEY, COVENTRY



NEWALL BRANDED BOLTS

Newall Hitensile... Newalloy... Newallastic... Newall Hi-tem

... are recognised by engineers as having unique qualities. We shall be happy to supply any engineer designer who is interested with details of the various bolts and studs, which cover the full range of modern requirements.

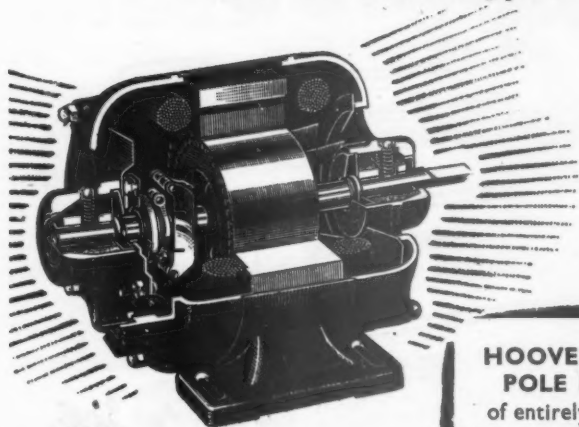
A.P. NEWALL & CO., LTD. POSSILPARK GLASGOW

Many well known firms are now fitting

HOOVER

FRACTIONAL HORSE-POWER MOTORS

in their electrical appliances



FOR many years Hoover engineers have been studying, designing, developing and perfecting small Fractional Horse-Power Motors. The result is the Hoover range of F.H.P. motors, considerable quantities of which are now being used by the leading manufacturers of electrical appliances.

Strongly constructed, compact in size and designed to give constantly uniform power under exacting running conditions, they are ideal for use on Refrigerators, Washing Machines, Pumps, Compressors, Catering Equipment, Machine Tools, etc.

Three basic types of squirrel cage induction motors are available: Split Phase, Capacitor Start or Three Phase. H.P. range 1/6, 1/4, 1/3, 1/2. Speeds 940, 1425 and 2850 rpm. Supplied with Solid or Resilient

**HOOVER SHADED
POLE MOTORS**

of entirely new design

Two types available:—

S.P. 300 Series

400 grm/cms. 1200 rpm. approx.

S.P. 200 Series

130 grm/cms. 950 rpm. approx.

Suitable for 200/250 volts.

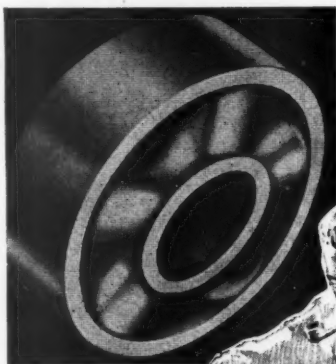
50 cycles A.C.

with or without mounting lugs.

mounting Ball or Sleeve Bearings. Thermal Overload protection (if desired). For all standard voltages. Full particulars and technical data will gladly be sent on request, or better still, may we send our representative to discuss your motor problems with you.

HOOVER LIMITED

PERIVALE • GREENFORD • MIDDLESEX



Pulley casting as used on double-acting Beche hammer. Weight in Elektron 850 lbs. Courtesy of the English Steel Corporation Ltd.

It's got to be strong!
It must be light!



The pulley had to be light because in power transmission the inertia forces must be kept low; but it had to be strong also because of the very high stresses which power transmission sets up. A pulley of the prescribed dimensions in any other material would have been too heavy (steel, aluminium and bronze had already proved unsuccessful); and, apart from the time lost in acceleration, and the high stresses caused by sudden braking, it would also have required excessive power to operate. That was the problem—and only Elektron magnesium alloys could solve it. They saved power, time and wear and tear.

But these are economies from which all moving mechanical parts, and especially vehicles, can profit. Greater acceleration, better braking capacity, reduced stresses, improved dynamic stability, higher speed—could your products benefit from such advantages? In other words, would they be better for being lighter? If so, you should consider the advisability of producing them in the lightest of all constructional metals:

"ELEKTRON"
Magnesium Alloys

*makes light
of weighty problems*

Write for particulars to:-

F. A. HUGHES & CO. LTD. BATH HOUSE 82 PICCADILLY LONDON W.1.

3

**DIRECT READING TO
2 SECONDS OF ARC**

3 IMPORTANT FEATURES

The table incorporates an entirely new system for reading the scale, which not only increases the accuracy with which the table can be set but entirely obviates the tendency to eye-strain and fatigue which sometimes arises after prolonged observation of scale readings through a microscope.



Other features:—(1) Re-designed Meehanite body giving increased strength; (2) A worm and wheel 2-speed hand drive, which can be disengaged. This drive enables a variety of light milling operations to be carried out with a degree of accuracy hitherto most difficult to achieve; (3) Scale can be pre-set enabling operator to set table for the next setting whilst work is proceeding on the previous setting.

The new table can be used with Jig Boring Machines, Precision Milling Machines or wherever highly accurate rotary indexing is required.

OMT

16" projection type ROTARY TABLE

OPTICAL MEASURING TOOLS LTD

NEWALL

ALL ENQUIRIES TO NEWALL GROUP (SALES) LTD PETERBOROUGH TEL 3227-8-9



200-TON HYDRAULIC PRESSES

Photographs by courtesy of
FERODO LTD.

★ A cold press of 200 tons capacity fitted with a 12" diameter ram—this unit is shown in action as an inspecting press stripping railmotor brake blocks from the hot dies after vulcanising.

NON-CORRODIBLE SURFACES
APPLIED BY "FESCOL"-ising

★ A 200-ton press fitted with a 12" diameter ram. Fitted on this press is a large mould for the manufacture of plastic mouldings of considerable area. The mould is heated by steam and electrically—provision is also made for water cooling.

The rams of both presses have been deposited in nickel with the result that corrosion is impossible and rust particles are not present to embed themselves in the leathers and thus cause "cording" of rams and leakage.

In the case of the large mould the whole of the contact surfaces have been "FESCOL"-ised in chromium with the result that the efficient life of the mould has been extended almost indefinitely.

★ Executives are invited to write for Booklet P.E.I. descriptive of the "FESCOL" process and the important role it is filling in many diverse industries.



FESCOL LIMITED

ORIGINATORS OF HEAVY DEPOSITION

SOLE LICENSERS FOR FRANCE: SOCIÉTÉ FESCOL, 149, RUE DU CHATEAU, BOULOGNE-MER-SEINE.
SOLE LICENSERS FOR AUSTRALIA: DE HOLLAND AIRCRAFT, PTY. LTD., MULPARA ROAD, BANKSTOWN, N.S.W.

Scottish Address: PORT GLASGOW

Northern Address: KARRIER WORKS, CABLE ST. HUDDERSFIELD

FESCOL

REGISTERED

TRADE MARK

**NORTH ROAD
LONDON N.7**

TELEPHONE "NORTH" 3025-6-7
TELEGRAMS: FESCOLDOM · PHONE · LONDON

MILLS

GROOVED PINS AND *Studs*



Used in over a hundred industries, replacing taper pins, screwed pins and many other types of fastening, with safety, efficiency and economy.

No reamering, no tapping, no threading required—simply drill a plain parallel hole and drive in the grooved pin or stud.

Made in steel, brass, copper, or with plated finish.

EXORS OF JAMES MILLS LTD BREDBURY STEEL WORKS
WOODLEY · N. STOCKPORT



The "Off the Shelf"
answer to your
Lathe and Planer
Tool needs

Wimet STANDARDS

Wimet

KNOW HOW

Simple angular modifications can be ground on a wet grinder using a green grit silicon carbide wheel, followed by lapping with a "Spedia" or "Neven" diamond cup wheel. Use diamond wheel directly for shallow cuts. Radii and special forms can be ground on a tool and cutter grinder or profile grinder, using diamond wheels of suitable shape. The standard range of diamond laps which we supply includes shapes suitable for grinding all normal modifications.

Write today for the booklet on the correct use and maintenance of Wimet tipped turning tools.

By stocking the full range of "Wimet" standard tools you are equipped to meet most Carbide tooling requirements easily and quickly.

"Wimet" standard tools are available from stock in ten popular styles and in all commonly used sizes.

Producing more per hour, with less "down time," reducing tooling costs by as much as 80 per cent yearly, they are the inevitable answer to your problem of faster and more economical production.

"THE WIMET AGE," a 16 m/m instructional sound film on the Application of Tungsten Carbide Tools is available for exhibition in Engineering Works, Technical Colleges etc. Please write for details.

Wickman

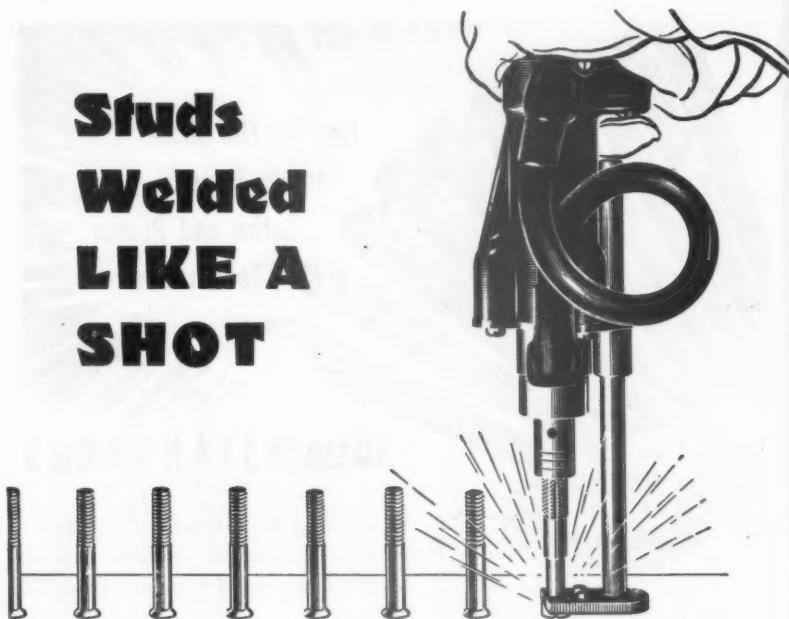
for



A. C. WICKMAN LTD • COVENTRY • ENGLAND
LONDON • BRISTOL • BIRMINGHAM • LEEDS • GLASGOW
MANCHESTER • NEWCASTLE • BELFAST

Wimet
TUNGSTEN CARBIDE

Studs Welded LIKE A SHOT



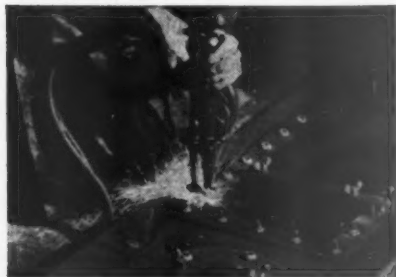
14 times faster than drilling and tapping

Why carry on with costly, time-wasting drilling and tapping when the Nelson Stud Welder can fix studs to steel 14 times faster? With this equipment, studs are so easy to fix that you can use special studs for all kinds of

jobs where bolts, pins and rivets were used before.

The Nelson Welding Gun is light and easy to handle—and absolutely safe. From the touch of the trigger the welding operation is completely automatic. This not only makes for high speed, it also ensures that every weld is of the same high quality.

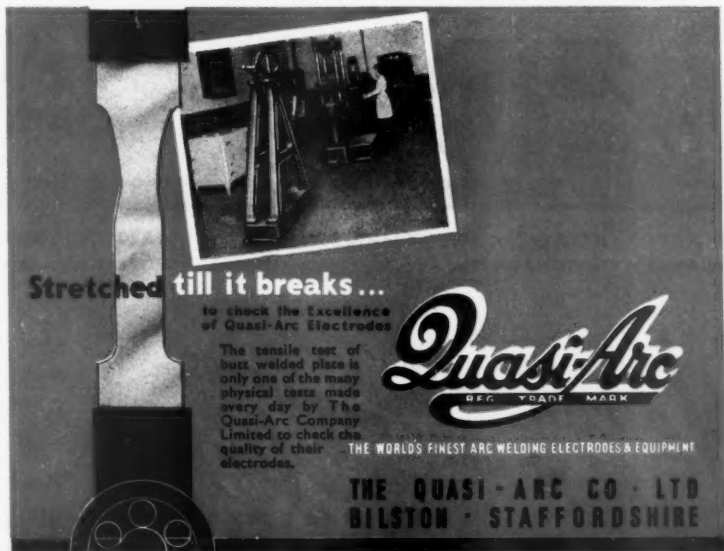
If fastening to steel is one of your problems, write to-day for the new Nelson brochure and find out how you can save time and cut costs.



Nelson stud welding on a transformer tank—one of the many time-saving cost-cutting applications. Strength and oil tight properties of tanks are unimpaired by Nelson welded studs.

NELSON STUD WELDING SERVICE

CROMPTON PARKINSON LIMITED
PLANT DIVISION
CROMPTON HOUSE, ALDWYCH, LONDON, W.C.2



Stretched till it breaks ...

to check the Excellence of Quasi-Arc Electrodes

The tensile test of butt welded plate is only one of the many physical tests made every day by The Quasi-Arc Company Limited to check the quality of their electrodes.

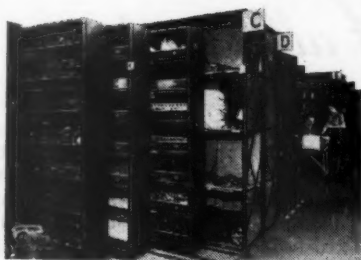
Quasi-Arc
REG. TRADE MARK

THE WORLD'S FINEST ARC WELDING ELECTRODES & EQUIPMENT

THE QUASI-ARC CO. LTD
BILSTON · STAFFORDSHIRE

3096M

The same store
but **STORMOR**
increased accommodation
by 33½%



1	2	3	4	5	6	7	8	1	8	9	14	19	20	25	30	31		
9	10	11	12	GANGWAY		13	14	15	16	2	GANGWAY						32	BEFORE
17	18	19	20	GANGWAY		21	22	23	24	3	GANGWAY						33	
25	26	27	28	GANGWAY		29	30	31	32	4	GANGWAY						34	
33	34	35	36	GANGWAY		37	38	39	40	5	GANGWAY						35	
41	42	43	44	GANGWAY		45	46	47	48	6	GANGWAY						36	
49	GANGWAY						50	7	GANGWAY						37			

Waste space is a serious overhead rarely taken into account.

Storage on the "Stormor" Mobile Storage Unit plan with its absolute minimum use of passages or gangways ensures the maximum storage capacity with the utmost accessibility and convenience. Let us show you, without obligation, how Stormor would improve your storage—simply write:

Study the plans given above and realise the difference Stormor Storage methods make.

STORMOR
MOBILE STORAGE UNITS

J. GLOVER & SONS LTD. GROTON ROAD, LONDON, S.W.18
Telephone: BATtersea 6511.

G.P.A.

G.P.A. TOOLS & GAUGES LIMITED**HARPER ROAD • WYTHENSHAW • MANCHESTER**
PHONE : WYTHENSHAW 2215.

GRAMS : PNEUTOOLS, PHONE

*We can now
accept your enquiries
for*

JIGS-FIXTURES & GAUGES

**PRESS TOOLS • MOULDS AND
SPECIAL PURPOSE MACHINES**

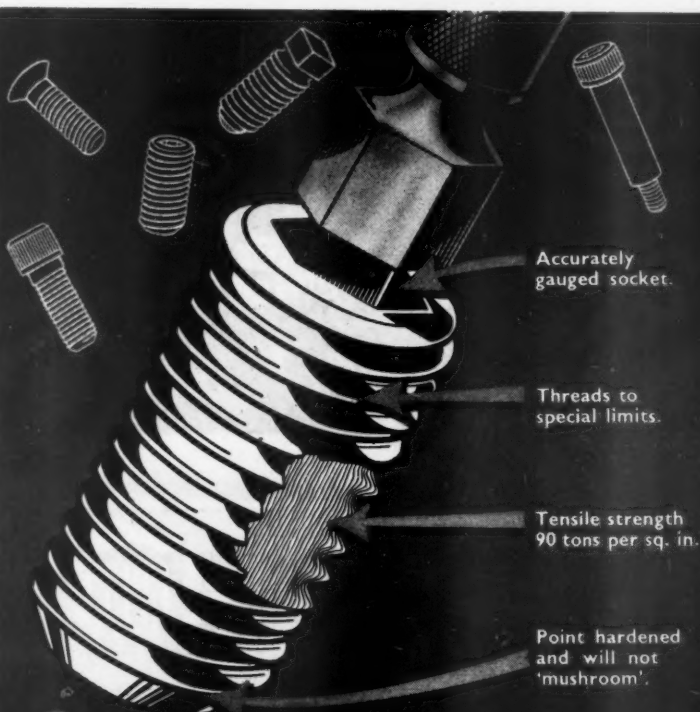
of all kinds



Up-to-date shops specially laid out and equipped for making, on a production basis, every type of precision ground gauges; limit snap, form, calliper, taper and special purpose gauge, as well as jigs and fixtures of all kinds, press tools, moulds and special purpose machines. Highest class workmanship and accuracy guaranteed.

G.P.A. TOOLS & GAUGES LIMITED**Guaranteed Precision Accuracy**

Members of the Gauge & Tool Makers' Association



It's a precision job

Every stage of manufacture of Unbrako Socket Screws is controlled; from the specification of high tensile steel ingots —through the various processes to heat treatment and final inspection and testing.

UNBRAKO

UNBRAKO SOCKET SCREW CO. LTD.
BURNABY ROAD, COVENTRY.

Stocked and Distributed by

CHARLES CHURCHILL & Co., Ltd., Coventry Road, Birmingham, 25



MATRIX

MULTI-DISC CLUTCHES

An asset to any machine specification

Coventry Gauge
& TOOL CO. LTD. BIRMINGHAM

The Council of the Institution

1948-49

President

DR. H. SCHOFIELD, C.B.E.

Chairman of Council

J. E. HILL

Vice-Chairman

W. C. Puckey

Past Presidents

Sir George E. Bailey, C.B.E.

The Rt. Hon. Lord Sempill, A.F.C.

The Rt. Hon. Viscount Nuffield, C.B.E.

N. Rowbotham, C.B.E.

Vice-Presidents

T. Fraser, C.B.E. E. W. Hancock, M.B.E. Sir Norman V. Kipping J. D. Scaife

Section Presidents

F. Bernard White.....*Birmingham*

T. B. Gray.....*Calcutta*

A. F. Pool.....*Cornwall*

W. N. Ellerby.....*Coventry*

J. B. Webster.....*E. Counties*

J. L. Bennet.....*Edinburgh*

H. Gardner.....*Glasgow*

H. Nutton.....*Halifax*

J. Wombwell.....*Leicester*

B. A. Williams, O.B.E.....*Liverpool*

F. P. Laurens, O.B.E.....*London*

J. W. Buckley.....*Luton*

H. G. Gregory.....*Manchester*

A. J. Bowron.....*N. Eastern*

J. C. Breakey.....*N. Ireland*

J. H. Bingham.....*Nottingham*

T. A. Westall.....*Preston*

G. R. Pryor.....*Sheffield*

N. J. Cottell.....*Southern*

W. J. Vaughan.....*S. Wales & Mon.*

J. E. Attwood.....*Western*

A. J. Aiers.....*Wolverhampton*

W. Armstrong, M.B.E.....*Yorkshire*

Additional Section Representatives

H. Burke.....*Birmingham*

F. C. White.....*Birmingham*

H. Eckersley.....*Coventry*

H. W. Bowen, O.B.E.....*London*

F. E. Maer.....*London*

R. K. Allan.....*Luton*

F. W. Cranmer.....*Manchester*

M. Seaman.....*Manchester*

J. F. Gibbons.....*N. Eastern*

A. S. Johnstone.....*Nottingham*

H. Kirkman.....*Preston*

.....*Western*

H. Tomlinson.....*Wolverhampton*

W. J. Marshall.....*Wolverhampton*

Lt.-Col. C. W. Mustill, M.B.E.....*Yorkshire*

Chairmen of Standing Committees

J. E. Baty

E. P. Edwards

F. H. Perkins

A. L. Stuchbery

Elected Members

F. Bloor, R. M. Buckle, B. H. Dyson, L. R. Evans, R. C. Fenton,

W. V. Hodgson, E. J. H. Jones, M.B.E., R. Kirchner, Prof. T. U. Matthew,

H. J. Swift, O.B.E., M. H. Taylor, S. Wright

Australian Sub-Council

President

E. C. PARKINSON

Chairman

E. L. OLFEN

Vice-Chairman

E. B. Richardson

Elected Members

H. le Cheminant

J. Finlay

S. D. McPhee

J. M. Steer

W. G. Davis

F. Glover

C. Pullen

J. E. Strick

South African Sub-Council

President

A. B. ANDERSON

Vice-President

A. C. WOTHERSPOON

Past Presidents

L. H. L. Badham J. Henry

D. Lion-Cachet

Elected Members

R. H. Arbuckle

P. F. Evans-Watt

W. Gillespie

D. A. Petrie

W. Caldwell

E. G. Fox

G. Godfrey

J. Renwick

H. H. Waters

Director and General Secretary of the Institution

Major C. B. Thorne, M.C.

Education Officer : T. B. Worth

HONORARY MEMBERS OF THE INSTITUTION

The Council has for some time past conferred on those who have rendered the Institution long and distinguished service the title of Honorary Member.

At the present time, the Honorary Members of the Institution are :

Mr. T. Fraser, C.B.E.

Sir Ernest J. H. Lemon, O.B.E.

Dr. G. Schlesinger.

Sir Alfred Herbert, K.B.E.

The Rt. Hon. Viscount Nuffield,
G.B.E., M.A., D.C.L.

The Rt. Hon. Lord Sempill, A.F.C.

Section Honorary Secretaries

Birmingham . . .	A. J. Mansell, 204, Alcester Road South, Birmingham, 14.
Calcutta . . .	J. Warren-Boulton, Machine Tools (India) Ltd., Stephen House, Dalhousie Square, Calcutta.
Cornwall . . .	F. W. Spencer, "Pembroke," Phillack, Hayle, Cornwall.
Coventry . . .	A. Hill, 382, Ansty Road, Coventry.
Derby Sub-Section .	A. Short, 26, St. Albans Road, Derby.
Eastern Counties .	L. A. Childs, Crane Ltd., Nacton Road, Ipswich.
Edinburgh . . .	P. H. Lee, 39, Corstorphine Bank Drive, Edinburgh, 12.
Glasgow . . .	W. P. Kirkwood, "Morar," Sandfield Avenue, Milngavie, Dumbartonshire.
Halifax . . .	Miss N. E. Bottom (acting), Hopkinsons, Ltd., Huddersfield.
Leicester and District	C. F. Gazard, 27, Stretton Road, Leicester.
Lincoln Sub-Section	E. E. Ingleton, "Glenroy," Lincoln Road, North Hykeham, Lincoln.
Liverpool . . .	F. Whitehead, 38, Cooper Avenue North, Mossley Hill, Liverpool, 18.
London . . .	H. W. Townsend, Philips Electrical Ltd., New Road, Mitcham Junction, Surrey.
Luton and Bedford	R. M. Buckle, 238, Cutenhoe Road, Luton, Beds.
Manchester . . .	H. E. Wheeler, 4, Marlfield Road, Grappenhall, Warrington, Lancs.
Melbourne (Victoria, Australia) . . .	C. Pullen, 13, Immarna Road, Camberwell, E.6.
North Eastern . .	H. B. Topham, C. A. Parsons & Co., Ltd., Heaton Works, Newcastle, 6.
Northern Ireland .	W. G. Wyman, "Linden Lea," Cultra, Co. Down.
Nottingham . . .	C. N. T. Manfull, Chellaston House, Thurgarton Street, Nottingham.
Preston . . .	F. M. Kemp, Clayton, Goodfellow & Co., Ltd., Atlas Iron Works, Blackburn, Lancs.
Sheffield . . .	E. Levesley, 259, School Road, Sheffield, 10.
Shrewsbury Sub-Section . . .	R. O. L. Cadman, 5, Perseverance Terrace, East Road, Ketley Bank, Oakengates, Salop.
South Africa . . .	The Secretaries, Institution of Production Engineers, Barclays Bank Buildings, Corner Commissioner and Harrison Streets, Johannesburg.
Southern . . .	S. Coates, 51, Westbury Road, Regent's Park, Shirley, Southampton.
South Wales and Monmouthshire .	S. T. O. Davies, 4, St. Cadoc Road, Heath, Cardiff.
Sydney (New South Wales) . . .	J. M. Steer, 260/262, Kent Street, Sydney.
Western . . .	A. Eustace, 19, Ferndale Road, Northville, Bristol, 7.
West Wales Sub-Section . . .	H. P. Sanderson, I.C.I. Ltd., (Metals Division) Waunarlwydd, near Swansea.
Wolverhampton . .	W. J. Marshall, Moston Park, Lee Brockhurst, Salop.
Yorkshire . . .	J. L. Townend, 26, Moor Allerton Drive, Street Lane, Leeds, 7.

Graduate Section Honorary Secretaries

Birmingham . . .	N. Newey, 185, Selly Oak Road, King's Norton, Birmingham, 30.
Coventry . . .	R. L. Crow, 65, Broad Lane, Coventry.
Halifax . . .	T. Marsden, 6, Kell Lane, Stump Cross, Halifax.
London . . .	R. T. Mustard, 47, King's Road, Woodham, Weybridge, Surrey.
Luton . . .	F. A. Rowley, 105, Hitchin Road, Luton, Beds.
Manchester . . .	W. R. Matley, 58, Heycroft Rd., Withington, Manchester, 20.
North Eastern . .	G. D. Robinson, 188, Westgate Road, Newcastle, 4.
Wolverhampton . .	L. C. Jones, 1 Meridale Lane, Wolverhampton, Staffs.
Yorkshire . . .	S. Metcalfe, "Marstan," 20, Heath Mount, Leeds, 11.

INSTITUTION NOTES

February, 1949

COUNCIL ELECTIONS 1949/50—NOMINATIONS

a) Members will appreciate that the vitality of the Institution depends entirely upon the ability and enthusiasm of those whom its members elect to Council. It is important therefore that every corporate member gives this matter his utmost thought during the forthcoming election.

b) In addition to Officers and Section representatives, Council includes twelve Elected members of whom two must be Associate Members. In accordance with Articles of Association 44 and 45, of these twelve members the six who have been longest in office since the date of their last election retire annually, but they may seek re-election.

c) In accordance with Article 49, nominations are now invited to fill six vacancies for Elected members to serve on Council for 1949/50, (five Members and one Associate Member).

d) Candidates for election must be nominated in writing by three Members or Associate Members of the Institution, nominations to reach Head Office by not later than 15th March, 1949.

e) In addition to nominations as at (d), each Section Committee may nominate one candidate.

f) The following are the six members who will retire in 1949 (see para. (b)) and are eligible for re-election. **No nomination** is required in respect of any of these gentlemen. This exception to the rule is provided for in Article 49.

1. Mr. R. M. Buckle, M.I.P.E.
2. Mr. L. R. Evans, M.I.P.E.
3. Mr. R. C. Fenton, M.I.P.E.
4. Mr. W. V. Hodgson, M.I.P.E.
5. Mr. M. H. Taylor, M.I.P.E.
6. Mr. S. Wright, M.I.P.E.

TECHNICAL EDUCATION

A vacancy exists for a Senior Lecturer in Production Engineering (Machine Tools and Jig and Tool Practice) in the Department of Aircraft Economics and Production of the College of Aeronautics. Applicants should be fully trained engineers, preferably with B.Sc. degree or equivalent in Mechanical Engineering, with considerable knowledge of the design,

manufacture and operation of machine tools, and of jiggling and tooling in the light engineering industry. Specialised experience in the aircraft, aero-engine or other precision engineering branches is desirable. Experience in teaching these subjects is desirable, but not absolutely essential.

Full particulars may be obtained from The Registrar, The College of Aeronautics, Cranfield, Bletchley, Bucks.

**GRADUATESHIP
EXAMINATION,
1949**

1. The Graduateship Examination of the Institution of Production Engineers will be held on Friday and Saturday, April 29th and 30th, 1949.
2. Examination Entry Forms, which are obtainable from the Head Office of the Institution, must be despatched *so as to reach the Head Office by not later than the 18th March, 1949*, and must be accompanied by an entrance fee of ten shillings.
3. No entry will be accepted unless accompanied by a Form of Application for Junior Membership.
4. Candidates must be under 28 years of age.
5. Rules and Syllabus and copies of past two years Examination Papers may be obtained from the Head Office (price 3d. per set).
6. Full details of the Examination will be sent to every candidate.

**FORMATION OF
DISCUSSION GROUP**

A Discussion Group has recently been formed by the Wolverhampton Graduate Section, for the purpose of holding informal discussions on all aspects of Production Engineering, with special reference to its effect on members of the Section.

These Discussion Meetings will be held in addition to the normal lecture meetings and works visits.

NEWS OF MEMBERS

Mr. E. G. Gilberthorpe, A.M.I.P.E. is now Works Manager of S. M. Wilmot & Co. Ltd., Bristol.

Mr. B. G. L. Jackman, M.I.P.E. is now Works Director of British Heat-Resisting Glass Co., Bilston.

Mr. S. R. Kay, Grad.I.P.E. has been appointed Mechanical and Electrical Superintendent to the City of Coventry Gas Department.

Mr. W. G. Middleton, A.M.I.P.E. is now Assistant Manager at the Royal Ordnance Factory, Woolwich.

OBITUARY

The Institution deeply regrets to announce the deaths of Mr. T. White, M.I.P.E., and Mr. T. S. G. Neville, A.M.I.P.E., both of Glasgow Section, and Mr. D. V. Gallon, Grad.I.P.E. of Yorkshire Section.

ISSUE OF JOURNAL TO NEW MEMBERS Owing to the fact that output has to be adjusted to meet requirements, and in order to avoid carrying heavy stocks, it has been decided that the Journal will only be issued to new Members from the date they join the Institution.

IMPORTANT In order that the Journal may be despatched on time, it is essential that copy should reach the Head Office of the Institution not later than 40 days prior to the date of issue, which is the first of each month.

SECTION MEETINGS

The following meetings have been arranged to take place in February and March, 1949. Where full details are not given, these have not been received at the time of going to press.

February

- 2nd LIVERPOOL SECTION. An informal discussion between Members only will be held at the Exchange Hotel, at 7-15 p.m.
- 2nd NOTTINGHAM SECTION. A lecture on "Purchasing to Schedule" will be given at the Victoria Station Hotel, Nottingham, at 7-00 p.m.
- 2nd PRESTON SECTION. A lecture on "Mechanical Mishaps and Their Relation to Design and Workmanship" will be given by Mr. G. E. Windeler, M.I.Mech.E., M.I.Mar. E., M.Consulting E., at Clayton Goodfellow & Co. Ltd., Blackburn.
- 2nd WOLVERHAMPTON SECTION. A lecture on "Production of Fine Surface Finishes" will be given by Mr. H. W. Lawton, A.M.I.Mech.E., Grad.I.P.E., at the Dudley and Staffs Technical College.
- 3rd GLASGOW SECTION. An informal discussion on "Improved Production Methods and Management" will be held at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, at 8-00 p.m.
- 4th WEST WALES SUB-SECTION. A lecture on "The Production of Steel Sheets" will be given by Mr. H. H. Stanley, A.M.I.P.E., at the British Iron and Steel Research Association Laboratory, Sketty Hall, Swansea, at 7-30 p.m.
- 5th YORKSHIRE GRADUATE SECTION. A visit will take place to Messrs. Phelon & Moore, Ltd., Cleckheaton, at 10-00 a.m.
- 7th YORKSHIRE SECTION. A lecture on "Die Casting" will be given by Dr. Street at the Hotel Metropole, Leeds.

February—cont.

- 8th COVENTRY GRADUATE SECTION. A lecture on "Some Aspects of American Production" will be given by Mr. D. Burgess, M.I.P.E., in Room A5, Technical College, Coventry, at 7-15 p.m.
- 8th BIRMINGHAM GRADUATE SECTION. A lecture on "Generation of Fine Finishes by Machining Techniques" will be given by Mr. P. Spear, B.Eng., Grad.I.P.E., at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-00 p.m.
- 9th SHEFFIELD SECTION. A lecture on "Cutlery Manufacture" will be given by Mr. E. Allen at the Royal Victoria Station Hotel, Sheffield, at 6-30 p.m.
- 9th WESTERN SECTION. A lecture on "Induction Heating" will be given by Mr. W. J. G. Cosgrave, B.Sc., A.I.M., at the Grand Hotel, Bristol, at 7-15 p.m.
- 9th MANCHESTER SECTION. A visit will take place to the Oil Well Engineering Co. Ltd., Cheadle Heath, Stockport, at 2-15 p.m.
- 9th LUTON GRADUATE SECTION. A lecture on "Die-casting" will be given by Mr. R. W. Bailey, M.A., B.Sc. (Oxon.), at the Town Hall, Luton, at 7-30 p.m.
- 10th BIRMINGHAM SECTION. An afternoon visit will take place to the Standard Motor Co., Ltd., Tractor Plant.
- 10th CORNWALL SECTION. A lecture on "Electronics in Industry" will be given by Dr. E. J. B. Willey, at Holman's Canteen, Dolcoath Road, Camborne, at 7-15 p.m.
- 11th WESTERN SECTION. A lecture on "Jig and Tool Design" will be given by Mr. R. O. Jeakings, at Wheatstone Hall, Brunswick Road, Gloucester, at 7-30 p.m.
- 11th EASTERN COUNTIES SECTION. A discussion on "The Position of the Production Engineer in Relation to National Economy" will be held at the Lecture Hall, Electric House, Ipswich, at 7-15 p.m.
- 11th WOLVERHAMPTON SECTION. A lecture on "Metallurgy" will be given by Dr. T. Wright at the Wolverhampton and Staffs Technical College, at 7-15 p.m.
- 11th COVENTRY SECTION. A lecture on "Broaching—Machines, Tools and Practice" will be given by Mr. E. Percy Edwards, M.I.P.E., in Greyfriars Room, Geisha Cafe, Coventry, at 7-00 p.m.
- 11th LONDON SECTION. A visit will take place to Messrs. Harris Lebus Ltd.—Manufacturers of Furniture—at 2-30 p.m.

February—cont.

- 14th **HALIFAX SECTION.** A lecture on "Development in High Frequency Heating of Metals" will be given by Mr. T. G. Tanner at Whiteley's Cafe, Westgate, Huddersfield, at 7-00 p.m.
- 16th **EDINBURGH SECTION.** A lecture on "The Education of the Production Engineer" will be given by Mr. T. B. Worth, M.I.P.E., A.M.I.Mech.E., A.M.I.E.E., at the North British Station Hotel, Edinburgh, at 7-30 p.m.
- 16th **LIVERPOOL SECTION.** A lecture on "Education for Management" will be given by Lt.Col. Urwick, O.B.E., M.C., M.A., C.I.Mech.E., M.I.P.E., F.I.I.A., at Radiant House, Bold Street, Liverpool, at 7-15 p.m.
- 16th **BIRMINGHAM SECTION.** A lecture on "Recent Developments in the Glass Industry" will be given by Sir Hugh Chance at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-00 p.m.
- 17th **GLASGOW SECTION.** A lecture on "Valid Incentives" will be given by Mr. E. C. Gordon England, M.I.P.E., F.R.Ac.S., F.I.I.A., at the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, at 7-30 p.m.
- 17th **LEICESTER SECTION.** A lecture on "The Application of Colour in Factories" will be given by Mr. Neville Sykes, A.M.I.Mech.E., A.M.I.E.E., in Room 104, Leicester College of Technology, The Newarques, Leicester.
- 17th **LONDON SECTION.** A lecture on "The Development of Electronic Equipment" will be given by Mr. J. L. Thompson, M.Brit.I.R.E., and a lecture on "The Electronic Control of Machine Tools" will be given by Mr. S. A. Ghalib, B.Sc., A.M.I.E.E., at a joint meeting between the British Institute of Radio Engineers and the Institution of Production Engineers, in the Assembly Hall, Royal Empire Society, Northumberland Avenue, W.C.2 (Craven Street entrance), at 7-00 p.m.
- 18th **NORTH EASTERN GRADUATE SECTION.** A lecture on "Jig and Tool Design" will be given by Mr. M. Davidson at Neville Hall, Newcastle-on-Tyne, at 6-30 p.m.
- 19th **MANCHESTER SECTION.** A lecture on "The Production Engineer—His Education and Training" will be given by Mr. T. B. Worth, M.I.P.E., A.M.I.Mech.E., A.M.I.E.E., at the Mechanics Institute, Crewe.

February—cont.

- 19th YORKSHIRE GRADUATE SECTION. Some Short Papers will be given at the Midland Hotel, Bradford, at 2-30 p.m.
- 21st MANCHESTER SECTION. A lecture on "The Position of the Production Engineer in Relation to National Economy" will be given by Mr. T. S. Smith, B.Sc., M.I.Mech.E., M.I.P.E., at the Manchester College of Technology.
- 21st NORTH EASTERN SECTION. A lecture on "Air Operated Fixtures" will be given by Mr. N. P. Watts at Neville Hall, Newcastle-on-Tyne, at 6-30 p.m.
- 21st DERBY SUB-SECTION. A lecture on "Education of the Production Engineer" will be given by Mr. T. B. Worth, M.I.P.E., A.M.I.Mech.E., A.M.I.E.E., at the Art School, Green Lane, Derby, at 7-00 p.m.
- 22nd LUTON SECTION. A lecture on "One Aspect of Sand Casting" will be given by Mr. J. W. Gardom.
- 22nd LINCOLN SUB-SECTION. A joint meeting with Grantham Engineering Society who will hold a "Brains Trust" will take place at Aveling Barfords Canteen, at 7-45 p.m.
- 23rd MANCHESTER GRADUATE SECTION. A lecture on "The Manufacture of a Typewriter" will be given by Mr. R. N. Evans, in the Reynolds Hall, College of Technology, Manchester, at 7-15 p.m.
- 26th HALIFAX GRADUATE SECTION. The Annual General Meeting will be held at the White Swan Hotel, Halifax, followed by a film afternoon including the "Age of Precision" and "Highway to Production." The Meeting will commence at 2-00 p.m.

March

- 2nd NOTTINGHAM SECTION. The Annual General Meeting will take place at Victoria Station Hotel, Nottingham, at 7-00 p.m.
- 2nd PRESTON SECTION. A lecture on "Modern Surface Coating and Post War Synthetic Finishes" will be given by Mr. C. A. J. Taylor, M.Sc., A.R.I.C., at the Harris Institute, Preston.
- 2nd WOLVERHAMPTON SECTION. A lecture on "Colour Schemes for Factory and Machines" will be given by Mr. S. A. Wood, at the County Technical College, Wednesbury.
- 3rd GLASGOW SECTION. An informal discussion on "Developments in Production Engineering—Education" will be held at the Royal Technical College, Glasgow, at 7-30 p.m.

March—cont.

- 4th WEST WALES SUB-SECTION. An "Industrial Digest" evening will be held at the Technical College, Swansea, at 7-30 p.m.
- 5th YORKSHIRE GRADUATE SECTION. The Annual General Meeting, followed by a lecture on "Wire and its Application to Industry" given by Dr. R. Goodacre, B.Sc., will be held at the Great Northern Hotel, Leeds, at 2-15 p.m.
- 8th BIRMINGHAM GRADUATE SECTION. The Annual General Meeting will be held at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-00 p.m., when there will be an Address by the Chairman, Mr. J. D. Berry, Grad.I.P.E.
- 8th COVENTRY GRADUATE SECTION. A lecture on "Corby Iron and Steel Works of Stewarts and Lloyds Ltd." will be given by Mr. A Stirling, B.Sc., in Room A5, Technical College, Coventry, at 7-15 p.m.
- 8th MANCHESTER SECTION. A Works Visit to Manchester Oil Refinery Ltd., Trafford Park, Manchester, will take place at 2-00 p.m.
- 9th LUTON GRADUATE SECTION. A lecture on "Powder Metallurgy and the Engineer" (illustrated by slides) will be given by Mr. H. W. Greenwood at the Midland Hotel, Luton, at 7-00 p.m.
- 9th SHEFFIELD SECTION. A lecture on "Mass Production of a British Alarm Clock" will be given by Mr. E. S. Desmond at the Royal Victoria Station Hotel, Sheffield, at 6-30 p.m.
- 9th WESTERN SECTION. A lecture on "The Metallurgist's Place in Production Engineering" will be given by Mr. E. R. Gadd, F.I.M., at the Grand Hotel, Bristol, at 7-00 p.m.
- 11th EASTERN COUNTIES SECTION. A lecture on "Budgetary Control" will be given by Mr. B. B. Beaumont, in the Lecture Hall, Electric House, Ipswich, at 7-15 p.m., preceded by the Annual General Meeting at 6-00 p.m.
- 11th COVENTRY SECTION. A lecture on "Recent Developments in Automobile Gear Production" will be given by Dr. W. A. Tuplin, M.I.Mech.E., in Greyfriars Room, Geisha Cafe, Coventry, at 7-00 p.m.
- 12th COVENTRY GRADUATE SECTION. A Works Visit will take place to Stewarts & Lloyds Ltd., Corby.
- 14th HALIFAX SECTION. A lecture on "Mechanical Mishaps and their relation to Design and Workmanship," will be given by Mr. G. E. Windeler, M.I.Mech.E., M.I.Mar.E., at the White Swan Hotel, Halifax, at 7-00 p.m.

March—cont.

- 15th LINCOLN SECTION. The Annual General Meeting, followed by a lecture on "Management at the Crossroads" given by Mr. Lewis C. Ord, will take place at the Lincoln Technical College, at 7-15 p.m.
- 16th LIVERPOOL SECTION. A lecture on "Difficulties and Developments in Deep Drawing and Pressing" will be given by Dr. J. D. Jevons, B.Sc., F.R.I.C., F.I.M., at Radiant House, Bold Street, Liverpool, at 7-15 p.m.
- 16th EDINBURGH SECTION. A lecture on "Plastics in Engineering" will be given by Mr. F. T. Barwell, at the North British Station Hotel, Edinburgh, at 7-30 p.m.
- 16th BIRMINGHAM SECTION. The Annual General Meeting and a lecture on "Recent Developments in Grinding Practice" given by Mr. R. J. M. Whibley, A.M.I.Mech.E., will take place at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7-00 p.m.
- 16th MANCHESTER GRADUATE SECTION. The Annual General Meeting and a lecture on "Costing in Relation to the Production Engineer" given by Mr. W. A. Eastwood, A.C.W.A., will take place at Reynolds Hall, College of Technology, Manchester, at 6-45 p.m.
- 16th MANCHESTER SECTION. A lecture on "Development and Application of all Branches of Resistance Welding" will be given by Mr. C. A. Burton at the Mechanics Institute, Crewe.
- 17th WESTERN SECTION. A lecture on "Design for Welding" will be given by Mr. F. Jukes, A.M.I.Mech.E., A.M.I.W., at Exeter.
- 17th GLASGOW SECTION. The Annual General Meeting, and a lecture on "Production Research in America" given by Dr. H. Orenstein, M.I.P.E., will take place at the Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, at 7-30 p.m.
- 17th LEICESTER SECTION. The Annual General Meeting, Section President's Address, and Films on a popular technical subject, will take place in Room 104, Leicester College of Technology, The Newarke, Leicester.
- 18th NORTH EASTERN GRADUATE SECTION. A lecture on "Grinding" will be given by Mr. J. Stanniers at Neville Hall, Newcastle-on-Tyne, at 6-30 p.m.
- 21st MANCHESTER SECTION. A lecture on "Modern Alarm Clock Production" will be given by Mr. A. W. Marshall, at the Manchester College of Technology.

March—cont.

- 21st NORTH EASTERN SECTION. A lecture on "Noise and Vibration in Machinery" will be given by Dr. W. A. Tuplin, M.I.Mech.E., at Neville Hall, Newcastle-on-Tyne, at 6-30 p.m.
- 23rd WESTERN SECTION. The Annual General Meeting will be held at the Grand Hotel, Bristol, at 7-15 p.m.
- 24th LONDON SECTION. A lecture on "Pressure Welding" will be given by Mr. R. F. Tylecote, M.Sc., A.M.I.E.E., after the Annual General Meeting at the Assembly Hall, Royal Empire Society, Northumberland Avenue, W.C.2 (Craven Street Entrance), at 7-00 p.m.
- 25th COVENTRY SECTION. The Annual General Meeting will be held in Greyfriars Room, Geisha Cafe, Coventry, at 7-00 p.m.
- 26th BIRMINGHAM SECTION. The Section Annual Dinner and Dance will be held at the Botanical Gardens, Edgbaston.
- 26th YORKSHIRE GRADUATE SECTION. A Works Visit to Messrs. Price (Tailors) Ltd., Leeds, at 2-30 p.m. has been arranged.
- 28th DERBY SUB-SECTION. The Annual General Meeting, followed by a sound film "Precise Measurement for Engineers," will be held at the Art School, Green Lane, Derby, at 7-00 p.m.
- 30th HALIFAX GRADUATE SECTION. A lecture on "Metallurgical Factors Influencing the Machinability of Steels" will be given by Mr. L. W. Johnson, M.I.P.E., at the Technical College, Huddersfield, at 7-00 p.m.

MEASUREMENT OF PRODUCTION EFFICIENCY ONE DAY CONFERENCE

A one-day Conference to discuss the measurement of production efficiency was held at the Royal Empire Society, London, on 5th November, 1948, by the Institution of Production Engineers and the Institute of Cost and Works Accountants. The Meeting was significant because of its coincidence with the preliminary talks of the Anglo-American Productivity Council, and was attended by Mr. Basil D. Dahl, Commercial Attaché, American Embassy. Other prominent guests were Sir Ewart Smith, of the F.B.I. Productivity Secretariat, Dr. Alexander King, a member of the Lord President's Committee on Industrial Productivity, and Sir Leonard Browett, Director-General of the National Union of Manufacturers.

In opening the proceedings, Mr. J. E. Hill, M.I.P.E., Chairman of Council of the Institution of Production Engineers, stated that the Conference was intended to be the forerunner to the establishment of principles of production measurement which could be commonly applied to the manufacture of a wide range of equipment and commodities.

The Chairman, Mr. B. H. Dyson, M.I.P.E., then called upon Mr. L. W. Robson, F.C.A., F.C.W.A., A.I.P.E., to give his address on "Measurement of Production Efficiency."

Mr. Robson drew attention to the remarkable lack of comparable statistical data upon which to base comparisons of the efficiency of firms within the same industry. The most disturbing factor was that with existing manpower and equipment the levels of output were considerably lower than could be attained. He stressed the importance of the functions of the industrial accountant in measuring productivity and the necessity of his close co-operation with the production engineer. It was only through such co-operation that vital control information could be compiled.

Mr. Robson felt sure that this approach to the problem of measurement of achievement, if adopted throughout British industry, would result in managements attaining substantially higher levels of output from existing capital equipment and man-power. There would be other advantages, such as the availability of operating costs for like processes within a particular industry in a comparable form.

Comparable product costs were obviously unsatisfactory for the purpose of measuring productivity and operating costs for individual

processes, as a product cost embraced all costs, and there was the added complication of the widely varying quality and design of what was basically the same product of a particular industry.

Mr. Robson concluded by recommending :

(a) That the activities of individual research committees of professional bodies concerned with the technical and financial measurement of productivity should be co-ordinated.

(b) That the best-known procedures in evaluating productivity for industrial processes in terms of hours of output and cost should be studied and reduced to a form intelligible to management.

(c) That such information should be placed in the hands of all concerned with the problem of improving industrial productivity, namely individual managements, trade associations, the executives of nationalised enterprises, and the appropriate Government departments.

Contributions to the ensuing discussion were made by Mr. T. W. Delury, A.C.W.A., Mr. Mark Taylor, M.I.P.E. (Leicester), Mr. T. H. Nicholson, F.C.W.A., Mr. L. A. Crawley, A.I.P.E. (London), Mr. R. Appleby, M.I.P.E. (London), Mr. G. E. Bateson, A.M.I.P.E. (Birmingham), Mr. Hauxwell, A.C.W.A. (London), Mr. J. W. Buckley, M.I.P.E. (Luton), and Mr. J. Vaughan, M.I.P.E. (S. Wales).

At the afternoon session, which was opened by Mr. George Stone, F.C.W.A., President of the Institute of Cost and Works Accountants, Mr. W. C. Puckey, M.I.P.E., F.I.I.A., presented a paper on "Measurement and Management." In his opening remarks he emphasised that the success of any enterprise depended on detailed planning—that was the essence of good management. It was essential that managers should be conversant with contemporary developments and standards, and to this end they should make every effort to know the facts.

The Production Engineer should constantly check his achievements against the best of his class at home and abroad, and should always be ready to put into operation new productive ideas. The Departmental Supervisor should concentrate on machine utilisation, job and merit rating, output and quality and see that the workers are aware of his objectives. The Personnel Officer's job was to supply precise and graphic statistics to line supervisors, and establish his standards by comparison with the methods of other companies and other countries. The Cost Accountant should remember that quality and simplicity of statistics were more important than quantity, and should utilise more fully costs based on Standards and Quality Control methods. The same standards of comparison should be set on overheads as on direct labour.

The Time Study Man should furnish management with concise trend figures and stress motion study as well as time study. The

Chief Designer should regularly compare competitive articles from both home and abroad with his own designs, and should see that such analyses reach the Production Engineer.

The Factory Manager should compare the American rate of production, which was 2.2 to 1 over this country, with his own, and attempt at least to equal it. He should capitalise on the special spurt imposed on his own organisation in emergency, and should ensure that the workers were aware of his standards of expectancy.

In the distributive field, the cost of lifting and shifting, packing and dispatching, all added much to factory costs, and it was the Distribution Manager's contribution to attempt to reduce this cost.

Finally, as men liked to work for an efficient organisation, it was the Directors' job to foster a feeling of pride in the concern, and make known as many simple facts about the business as were required.

In conclusion, Mr. Puckey stated that there was no easy road to success in setting standards of performance. The manager had to consider how few really effective figures were necessary in order to control his business efficiently.

During the ensuing discussion, Mr. G. R. Pryor, M.I.P.E. (Sheffield), contended that an immediate contribution to production could be made by smaller firms, if they had the facilities for operational research available to larger concerns. Mr. Pryor suggested that a voluntary Development Panel might be formed in every important centre, with a permanent staff of skilled men who would help the small firms with their problems. He felt that the Government could well be asked for financial assistance to put this plan into action.

Contributions to the discussion were also made by Mr. C. M. McBean, A.C.W.A. (Coventry), Mr. J. McFarlane, M.I.P.E. (Glasgow), Mr. S. R. Howes, M.I.P.E. (Sheffield), Mr. E. A. Corbett, A.C.W.A. (Birmingham), Mr. H. N. Tennant, A.C.W.A. (Birmingham), Mr. W. Coutts-Donald, F.C.W.A. (London), Mr. H. P. Sanderson, A.M.I.P.E. (S. Wales), Mr. C. H. T. Williams, M.I.P.E. (Sheffield), Mr. E. Gordon England, M.I.P.E. (London); Mr. C. J. Luby, M.I.P.E. (Bristol), Mr. G. Witton, A.M.I.P.E. (London), Mr. C. G. S. Jennings, F.C.W.A., Mr. I. C. Green, M.I.P.E. (Glasgow), Mr. R. Warwick Dobson, F.C.W.A. (London), and Mr. R. Hutcheson, A.I.P.E. (London).

In summing up the Chairman said that possibly the main overall function of the research to be carried out by the Institution of Production Engineers and the Institute of Cost and Works Accountants was to find out how to simplify the facts, and subsequently put them into operation. It was management's job at all levels to use the tools at their disposal. A financial budget for the non-producing departments was possibly one of the most important

managerial targets. The review of actual expenditure was often made too late—more action should be taken in the earlier stages. As financial statements were apt to be misleading, it was important that a true standard should be used whenever possible. One of the biggest problems was how to open the "closed shop" of information, of interchange of technical costing, and of organisation functions.

It was also vital that management should determine its standards of expectancy before going into production. The problem of obtaining so much production per man hour had now changed to production per man hour at how much quality and how much cost—both factors which could be measured and were results of measurement.

Finally, the Chairman said that two main objectives had been defined as a result of the Conference—first, all those present should make it their business to propagate the fact that measurement of productivity must result in increased efficiency; this could best be done by example. Second, both the Institution of Production Engineers and the Institute of Cost and Works Accountants should base their further investigations on the carrying out of research on individual and industrial process operations, in order to establish a simple standard which could be used to measure difficult problems in industry.

Since this Conference was held, a Joint Committee has been set up in conjunction with the Institute of Cost and Works Accountants to devise the best means of measuring comparative productivity, and to discover methods of applying these measures for the purpose of increasing productivity. The members of this Joint Committee are :

Institution of Production Engineers :

Mr. W. C. Puckey (Joint Chairman), Mr. H. W. Bowen,
Mr. B. H. Dyson.

Institute of Cost and Works Accountants :

Mr. L. W. Robson (Joint Chairman), Mr. R. W. Dobson,
Mr. I. Morrow.

MEMORANDUM ON METHODS EMPLOYED TO ACHIEVE ECONOMY IN THE USE OF FUEL

As a result of a survey recently carried out by the Institution of Production Engineers in collaboration with its affiliated firms, with the object of ascertaining the effect on productivity of various methods employed to reduce consumption of fuel and power, the following observations are put forward.

The principal methods employed last winter were as follows :—

- (1) Staggered hours.
- (2) Transfer of equipment with heavy power consumption to night shifts.
- (3) Use of private generating plants.
- (4) Installation of power factor correction capacitors.
- (5) Economy in fuel for space heating.

These methods were used both singly and in combination.

STAGGERED HOURS

During the winter of 1947/48 approximately 25% of the firms who co-operated in this survey introduced some form of staggered hours. Although the necessary load-shedding was achieved, the majority of firms using this method stated that it had resulted in loss of production and increased costs. It also caused a considerable amount of unrest amongst labour, particularly amongst employees above the age of 60, and the incidence of sickness and absenteeism rose fairly heavily. Moreover, the staggered hours resulted not only in loss of production but in deterioration of quality.

NIGHT SHIFTS

A number of firms adopted with success a scheme whereby certain machine tools, furnaces or equipment using a considerable amount of power in relation to other machines, were used only on night shift. This method was very satisfactory, although it would not be suitable for every type of firm. In some companies this system of working was carried out by volunteers, whilst in others, particularly attractive terms had to be offered to the operators to induce them to transfer to permanent night shift for the winter months. This scheme had the merit of inconveniencing as few of the workpeople as possible, while the main body of the works carried on under normal conditions. In some cases, load-shedding during the day was found to be necessary in addition to these measures.

USE OF

**PRIVATE GENERATING
PLANT**

(a) Generators.

During last winter, approximately 35% of the firms covered by the survey already possessed their own generating plant or purchased it to supplement the public supply. For the coming winter of 1948/49, this percentage has been greatly increased, and is now approximately 50%.

In several cases, generators were employed in conjunction with other methods such as strict economy in space heating at peak periods. The full saving was achieved without adversely affecting production.

(b) Use of Fordson Tractors.

For small factories, it is worth while to mention the experiment of one firm who used continually, during the fuel economy period from 1st October until the end of March, four Fordson Major Tractors which were driven without any difficulty into line with the shafting and the drive taken from the Fordson power take-off. These Fordsons gave a consistent output of 30 h.p., the four machines giving a total output of 120 h.p. Incidentally, these tractors gave complete trouble-free service 44 hours per week over a period of six months. This would appear to be an ideal solution in circumstances where it can be operated.

**INSTALLATION OF
POWER FACTOR
CORRECTION CAPACITATORS**

A great saving can also be introduced by means of power factor correction capacitors. It is well known that alternating current apparatus takes from the line far more current than it uses, and if efficiency is to be obtained this flow of extra current must be eliminated. The installation of these capacitors generally produces a large saving, with no loss of production, and it is suggested that careful consideration should be given to the possibility of installing such equipment in all factories.

**GENERAL
COMMENTS**

The opinion was expressed by some firms that alternative schemes cannot be run satisfactorily in the same town. The employees do not understand why some firms can work normal hours whilst others cannot, and draw the conclusion that there is lack of ingenuity on the part of management; consequently, they feel resentment, and their output and its quality both suffer.

These misunderstandings could no doubt be corrected if fuller explanations concerning the operation of such schemes were given to the workpeople.

It is felt that individual firms should be allowed to adopt the most efficient means available for carrying out the necessary fuel and

THE INSTITUTION OF PRODUCTION ENGINEERS

power saving in their own particular case and the Regional Boards should undertake the necessary propaganda to convince the work-people of the need for such measures.

In putting forward this Memorandum, it is hoped that these observations may be of some value in assisting firms to effect the necessary savings without loss of production.

BALL AND ROLLER BEARINGS

by J. E. BATY, M.I.P.E.,
(Chairman, Standards Committee).

The subject of the assembly tolerances of ball and roller bearings has been raised recently at Finance and General Purpose Committee meetings and also at a Council meeting. The matter has been referred to the Standards Committee of the Institution for consideration. It is felt that this is a problem production engineers should be in a better position to deal with than anyone else and every member is urged to help by writing to Headquarters on this subject. If you use ball or roller bearings your mind is probably made up on the points raised below, and all we ask for is a paragraph stating your views.

There does not appear to be any criticism of the tolerances laid down in B.S. 292-1927 for eccentricity or 'wobble,' but some criticism has been raised on the magnitude of the tolerances for the 'Bore' and 'Outside Diameter' in this specification.

There are certain applications of rolling bearings which require very special tolerances—such as aero-engines and the finer classes of machine tools—but these for the time being may be considered as special cases. Your Standards Committee is desirous of finding if the diametral tolerances laid down in the existing specification fulfil the general requirements of industry.

Two main criticisms have been advanced :—

- (a) Tolerances are too wide for interchangeability.
- (b) The finely graded clearances between the balls (or rollers) and the raceway may be seriously interfered with if too tight a fit is obtained on assembly, and the proper performance of the bearing would thus be impaired.

Of course a tightening of the tolerances for ball and roller bearings would involve equally close tolerances for bearing housings and shafts on which they must fit.

It should be stated that any tightening up of tolerances for ball and roller bearings would be a matter for the future due to the present acute shortage, but it is desirable to get the opinion of industry now so that whatever investigations are necessary may be put in hand with the view of revising the specification, should that course be found desirable.

THE INSTITUTION OF PRODUCTION ENGINEERS

The Standards Committee would be glad to have information from members who use ball or roller bearings in their manufactures, saying whether or not they consider bearings, as at present made to B.S. 292, are satisfactory for general requirements. If you have suggestions to make as to appropriate tolerances for this class of bearings the Standards Committee will be glad to have them, but our main concern at present is to get a consensus of opinion on the present rolling bearing tolerances. With your opinion please state on what machines or apparatus you use such bearings.

ALUMINIUM ALLOY GRAVITY DIE CASTINGS AS AFFECTING THE PRODUCTION ENGINEER

by H. C. CROSS.*

*Presented to the London Graduate Section of the Institution, March 9th,
1948.*

In preparing this paper on the manufacture of aluminium alloy gravity die castings, I had in mind not so much the technical aspect of producing these castings, but rather the idea of giving Production Engineer, Designer and Buyer a general review of practical manufacture, and problems which confront the foundry in supplying a satisfactory article to meet the requirements of the customer in every way. This means that the casting must fulfil in the most efficient manner, the job for which it is intended, and the aluminium alloy which is selected must be suitable for the particular application desired. The price of the casting is not so much controlled by the value of the material as the labour expended in producing it, overhead charges generally being directly associated with the direct labour costs. In these days when higher production is so necessary and is being stressed all round, various ways and means are being devised to achieve it and team work is vital to obtain the best results. This is why it is so essential for the Foundry Engineer, Production Engineer, and Designer to work together in the early stages, in order to ensure that ;

- (1) the article produced is simple in design from the foundry angle, so that a sound casting can be made at an economical price by modern foundry methods.
- (2) the minimum of machining and additional work is expended.
- (3) the casting is efficient in its phase of application.

The advice of the Foundry Engineer, who has specialised knowledge of the alloys through constant use and experience, can be of considerable help as the material selected has a special bearing on the die design and the subsequent production of the casting. The design of the casting is also important, for soundness and ease of manufacture. Foundry work is a specialised job, with a multitude of problems arising from day to day, and if it is possible for this co-operation to be obtained, each man seeing the other's point of view and meeting him in his problems, the tendency will be to promote general good feeling and efficiency. In most cases it will be found

* *Technical Sales Manager, John Dale, Ltd.*

that a suitable compromise can be reached which is acceptable to all concerned, and this will have a most beneficial effect on production and the subsequent price of the finished article. I propose, therefore, to go through the various phases of manufacture from the time the initial drawings are produced until the finished casting is made.

Whilst this paper is dealing primarily with aluminium gravity die castings, it is just as well to compare these with sand and pressure die castings, so that we have it clear in our minds that the gravity die method is the most suitable one for the casting concerned. Selection of the material, simple points of design, and die design will also be dealt with, together with inspection and final finishing.

Foundry work is very interesting and valuable information can be obtained from a visit to see actual castings produced. However, it is perhaps better to have some idea of the process in the first place and if I can bring to light some of the problems with which the foundry is faced, and by doing so achieve the interest and co-operation of the Designers and Production Engineers, I shall feel that this paper has been well worth while.

At this stage I think we will now proceed to consider the relative position of gravity die castings as compared with other methods of manufacture.

SAND CASTINGS

The manufacture of commercial sand castings is normally considered to be the least complicated of the three forms, the general equipment required being of a simpler type. It consists of the necessary moulding boxes and parts, chains, hoisting tackle, patterns, coreboxes, the necessary sand and the furnace in which to melt the alloy ingot. For this reason there are endless small firms dotted about the country who can supply small quantities of castings at reasonable prices. Many of the very large companies in existence to-day started in a small way and have become modernised to a very high degree, their technical skill and scope developing at the same time. With this comes the ability to manufacture complex castings in higher grade materials where in conjunction with the laboratory, chemical and spectographic analysis, and technical apparatus such as microscopes and X-ray can be used in conjunction with foundry technique to produce very high quality castings.

It is necessary to make a separate mould each time the casting is made; this is destroyed upon knocking out the casting. Even so the use of sand castings is very extensive in the engineering and general industries and the total output as regards weight is far in excess of gravity die castings and pressure castings. It is usually necessary when preparing prototypes to have the first few made in

sand so as to stabilise the designs, before considering large quantities. The casting technique in sand is rather easily adjusted as the founder has a large choice in the location of his gates and feeders so as to give a progressive solidification to the casting. Where these are not adequate, metal chills can be introduced into the mould to cool off quickly heavy sections which cannot be conveniently reached with feeders. Complicated cores can be used which will produce bosses and webs from which a simple metal core cannot be extracted, owing to extensive undercuts. Modifications can be quickly carried out to pattern equipment should last-minute alterations be required. The question of the size of the casting also is not limited, providing the foundry has the necessary lifting tackle, moulding boxes, core drying capacity and furnace capacity to suit. It is necessary for this larger intricate work to employ fully skilled men and the output per man hour is smaller than in the case of die castings. In a modern sand foundry, however, a high degree of mechanisation is being instituted and high production rates of medium sized castings can be produced with semi-skilled men on moulding machines using specially laid out patterns.

The standard of accuracy is also higher and the castings dimensionally more uniform than those that are hand made. This is due to the fact that there is no need for rapping, which tends to make the castings oversized and vary slightly from one to the other. Even so, neither the finish nor the accuracy is equal to that of gravity die or pressure die castings. Machining allowances, therefore, have to be increased to allow the castings to clean up to finished drawing dimensions. Greater care also has to be taken with the locations when using jigs and tools. Generally speaking, it is advisable to locate off a moulded portion, which is more consistent owing to the fact that cores are apt to vary slightly in their location in the sand mould, thus producing varying wall thicknesses.

Sand castings can be produced more speedily as the time in preparing the patterns would, on the average, be about one-third of that taken for dies, and after approval of the sample casting, production could be commenced within a few days.

To sum up, therefore, the use of sand castings is advised :

- (1) for prototype and experimental work and the manufacture of small quantities where the cost of expensive dies, spread over this number, would be uneconomical—the cost of the pattern equipment being very much lower.
- (2) where castings, by virtue of their large size or complicated internal design, are not suitable for economical production by the gravity die or pressure method.

- (3) where the alloy required cannot be die cast satisfactorily owing to lack of fluidity or hot shortness as for some of the high strength materials ; also where sand cores would have to be used to produce very complicated internal shapes from which the core gases could not easily escape if enclosed in a die.

**PRESSURE
DIE CASTINGS**

This method has much to recommend it when very large quantities of accurate castings are required. The finish is very good and owing to the high pressures which force the metal into the die, has very sharp delineation.

It is most useful in the case where fine lettering, trade marks, etc., are required on the casting. To achieve this, the dies have to be machined very accurately so that there is no leakage between joint faces, and the finish has to be exceptionally fine otherwise tool marks, etc., would be revealed on the surface of the casting.

Fettling costs would be reduced to the minimum as very fine gates can be used owing to the high pressures utilised. These small gates can be cleaned off quite easily without damaging the appearance of the casting. The joint faces can also be cast very flat and true if no machining is required, and where holes can be cast within the extraction compass of the machine, these are sharp and need less taper than in the case of gravity die casting.

The smooth finish obtained greatly assists in the final finishing of the casting, especially in the case of zinc base pressure castings which can be plated directly on to the casting, e.g., a car door handle. The castings must be fairly simple in design without multi-piece cores, and the design generally must be such that the die can be opened mechanically and the casting ejected. The sections must also be uniform, otherwise shrinkage and general unsoundness can be expected in the heavy sections. The castings are not as strong as gravity castings, owing to the gates being small and cut off being instantaneous ; the solidification is not as progressive as it is in gravity castings, where the feeders are kept alive by hot metals which feed the casting as it gradually cools—the reduction of volume between liquid and solid being in the region of seven per cent.

The size of the casting produced is somewhat limited by machine size and the high pressures per square inch required. The dies also are very costly to make owing to the expensive steels necessary to withstand the high friction caused by the ingress of the metal, and also to the additional cost of machining these materials and

the high grade of accuracy necessary to make them leak-proof. The chief points, therefore, to bear in mind when considering this process are :—

- (1) whether the quantity is sufficiently large to justify the expense of dies.
- (2) whether the casting, by virtue of its simplicity in design, is suitable for production by this process.
- (3) whether the mechanical consideration or soundness required is acceptable.
- (4) whether the advantages gained in elimination of machining and ease of finishing are a prime consideration.

GRAVITY DIE CASTINGS

This method of manufacture is very popular and one that is used extensively in the automobile, electrical, general engineering and allied trades, and seems to fill a large sphere of application between the fields of sand and pressure die casting.

As the name implies, the hot metal is fed into the cast iron or steel collapsible mould by its own weight and is allowed to solidify. The mould or die is then opened either by levers or mechanical means and the casting extracted. The operation is rather slower than the pressure die or machine operated die, particularly owing to the fact that the freezing time takes longer, the metal being hotter and the feeders larger. The casting produced, however, is stronger and of a denser structure than sand and pressure castings, owing to the chilling effect of the die and the feed back from the risers, which gives a more progressive solidification.

The finish of the casting, while not normally as good and sharp as a pressure die casting, is infinitely superior to a sand casting and a high grade of accuracy can be maintained within reasonable limits. In comparison with sand castings the machining can be very much reduced and where necessary cut down to the lowest minimum. The castings can be located in jigs more accurately owing to a higher overall dimensional accuracy.

In these days, when it is necessary to conserve vital machining capacity, an accurately made die casting is a very useful ally as it can be made with no machining on the joint face when washers are used, and bolt holes can be satisfactorily included if not too small. Brass or steel bushes, steel tubes, or other items which would normally have to be pressed or screwed into place, can be satisfactorily cast into the casting.

SELECTION OF MATERIAL

Aluminium castings is a very broad term used to denote that castings are made in an aluminium base material ; it is not generally realised by the layman that very few of the castings are made in pure aluminium. This is mainly due to the fact that aluminium is very difficult to cast

owing to its lack of fluidity and high shrinkage properties, which cause bad cracking. In any case it has very little to recommend it, although it has high electrical conductivity and good anodising and colouring qualities. In the cast form its strength is very low and it is very soft. It is usually alloyed with other elements such as copper, silicon, magnesium, manganese, zinc, etc., which considerably improves its physical properties and presents it in a more suitable casting form.

There is no end to the combinations of alloys which can be made and a very small difference in the quantity or variety of the alloying agents will considerably alter the properties. Special research work, however, has been carried out and is still proceeding, and certain alloys have been evolved for general and special purposes. These are covered by a series of specifications issued by the British Standards Institution, BSS, and the Director of Technical Development, DTD. These specifications are the ones normally used. The foundries are anxious not to increase the number of alloys used owing to the furnace capacity which would be required, but to reduce wherever possible. When selecting an alloy, therefore, it is advisable to give alternative specifications, especially where the higher grade materials are required such as for aircraft. There are a number in a group such as DTD.298, DTD.300 and DTD.304, where the foundry would like to select the particular alloy which is in constant use, as it is not economical to make melts in special materials for small runs. In selecting the alloy it is advisable first to consult the specifications for the secondary alloys, as these are made from scrap material readily available and are economical in price. They also comply to definite standards and are much used in foundries for general purpose work. It would not be possible, of course, in the confines of this paper to deal with all types of alloys, but a few of the more important ones are given at the end of this section.

It would be as well to mention that in considering the strengths of the alloy selected it should be borne in mind that standard specification test bar figures are not always what can be expected in the final casting. Test bars are uniform in section and are poured under ideal conditions into specially designed sand moulds; in the circumstances this could not be attained on a normal casting in the foundry, owing to its differing sections and shape which cannot be fed so adequately or crystallise so progressively. Whilst the die casting being chilled would tend to be superior to sand castings, it does depend on the uniformity of the section as to whether chill-cast or even sand-cast test bar figures would be realised. The reason, of course, for taking a test bar is to prove that the material used is consistent from one batch to another, conforms to a definite

analysis and that heat treatment, if called for, has been carried out properly, so that the maximum physical characteristics will be achieved in the castings as compared with the test bar figures.

If the casting is highly stressed it will be necessary to choose a heat-treatable alloy of the high purity class, as the introduction of impurities will tend to reduce the strength and ductility which would be vital in the case of aircraft castings, where the Designer is out to save as much weight as possible. This obviously must be taken into consideration in the price charged for the casting. The writer has known instances when castings have been type tested and the factor of safety called for has been more than doubled. A lower strength material could have been used in this case without increasing the weight and at a very much more economical price. It is far better at times to use a moderate strength alloy from which a sound casting can be produced, than an alloy which is difficult to cast, has a tendency to crack, and on which there is a considerable amount of scrap in the Foundry and Inspection Department.

Whilst under ideal conditions a superior casting may be achieved which will give slightly higher strength, the cost is sometimes excessive. The selection of material for a certain purpose does, therefore, have to be considered together with the design of the casting as a whole, as the die design is also affected, especially in the case of materials which are 'hot short.' This term applies to certain alloys which, at elevated temperatures in the die, are mechanically weak just below solidification point, setting up strains in cooling in the mould and tending to tear and crack. Sometimes these cracks are internal and cannot be detected by ordinary means and special methods such as X-ray have to be adopted. This will be dealt with later in the paper.

Modifications to design can in some instances materially affect the result and require the co-operation of the foundry technician at the outset. It is generally a bad practice to change alloys when the dies and tools have been specially made, as would be the case if it was contemplated to change from a general purpose material to an alloy of the high strength class. The whole design of the casting and die would have to be reconsidered and it might be necessary to scrap the die and make another. Alloys can roughly be assumed to fall into three main groups :

- (1) those used for general and commercial purposes in the automobile, electrical and general engineering industries.
- (2) those possessing good corrosion resisting properties.
- (3) the high-purity high-strength alloys such as are specified for aircraft and other vital jobs.

A few of the more popular alloys are listed below together with their chief constituents, physical properties, general characteristics and their suitability for various applications.

GENERAL PURPOSE ALLOYS

<i>Spec.</i>	<i>Approx. Composition</i>	<i>Uts. (Tons Sq. In.)</i>	<i>Elonga- tion % Min.</i>	<i>Special Properties and Uses</i>
DTD.424	Copper 3% Silicon 5% Manganese Iron Magnesium Nickel, etc. Remainder Aluminium	9	2%	Good fluidity and corrosion resisting properties. Suitable for engine crank cases and parts, electrical apparatus, wringers, and for almost any item within its physical properties. Material developed in war time to use up scrap dural sheet and now very popular for post-war uses. Ingot price reasonable.
	} Impurities			
DTD.428	Copper 7% Zinc 3% Silicon 3% Minor Impurities Remainder Aluminium	8		This alloy is very similar to 732 alloy used before the war, and primarily used for simple die castings, having good fluidity and ease of casting. No outstanding properties. Ingot costs low.
LAC.113B	Zinc Copper Other Impurities Remainder Aluminium	9	2%	Suitable for commercial work, where castings are not subject to high stress or shock. Similar to commercial L.5 material used before the war. DTD.424 is now more popular and a better all round material.
3L-5	Zinc 13% Copper 3% Minor Impurities Remainder Aluminium	9	2%	For commercial sand cast work, crank cases, etc.; not very suitable for die castings as is rather hot short. Mostly replaced by DTD.424.
DTD.133C DTD.287	Copper and Nickel Iron Magnesium Silicon Titanium or Colombium Remainder Aluminium	10	2% 2%	This is a superior general purpose material with better properties than those mentioned above. Gives a better proof stress for simple heat treatment. Medium strength material of high shock resistance. The main difference between one material and the other is that titanium is used as a grain refiner in one instance and columbium in the other. Used for aero-engines, crank cases, cylinder blocks and can be used for Class I aircraft castings, petrol pumps, etc.

CORROSION RESISTING ALLOYS

<i>Spec.</i>	<i>Approx. Composition</i>	<i>Uts. (Tons Sq. In.)</i>	<i>Elonga- tion % Min.</i>	<i>Special Properties and Uses</i>
2L33	High Silicon 12% Minor Impurities Remainder Aluminium	10½	5%	Good for thin sections. High fluidity, not hot short, highly ductile and can be used for fairly complicated sand or die castings. Shock resisting. It is modified by metallic sodium or sodium salts to give its best qualities. Used for crank case sumps, water pumps, marine castings, and for small light assemblies.
DTD.240	High Silicon 12% Iron Magnesium } Manganese } Total other impurities 0.2 max. Remainder Aluminium	11	1½%	High Silicon Aluminium, high fluidity and similar casting properties to L.33. Single heat treatment only and usually called for where higher strength is necessary with lower ductility.
DTD.245	Similar to above.	15½		Same analysis as DTD.240 but fuller heat treatment solution and precipitation. Higher strength still with lower ductility.
The Silicon alloys generally do not machine easily, tend to tear and finish is poor. Tapping has to be carefully watched. Tool technique has to be carefully considered to obtain best results. Anodises a greyish colour, not suitable for colouring.				
DTD.165	Magnesium 3-6% Manganese 0.5% Total impurities 1% max. Remainder Aluminium.	9	3%	Good resistance to atmospheric and sea water corrosion. Not easy to cast in complicated shapes. Excellent for marine applications. Machines well and takes a nice polish. Anodises and colours well.

HIGH STRENGTH ALLOYS

DTD.298	Copper 4-5% Silicon 0.9% Iron 0.7% Titanium 0.25% Other minor impurities Remainder Aluminium	14	7%	High purity material. High strength and shock resisting, used on vital Class I aircraft castings. Specialised technique required, very hot short. Full solution heat treatment, quench in cold water. Is used for control column heads, aileron controls in aircraft and has been used as a substitute for light alloy forgings.
DTD.304	Similar to above	18	4%	Same analysis as above but a fuller heat treatment, solution and precipitation. Same casting characteristics with a higher ultimate strength and slightly less elongation.

HIGH STRENGTH ALLOYS (cont.)

<i>Spec.</i>	<i>Approx. Composition</i>	<i>Uts. (Tons Sq. In.)</i>	<i>Elongation % Min.</i>	<i>Special Properties and Uses</i>
DTD.300A	Magnesium 10% Aluminium With minor impurities	17	7%	Gives mechanical properties midway between DTD.298 and DTD.304. It is used on die casting jobs where the above mentioned alloys cannot be used owing to their hot short properties. Less cracking is experienced with this material. Specialised technique required. Solution heat treatment, quench in oil.
Y Alloy BSS.L.35	Copper 3.5-4.5% Nickel 1.8-2.3% Magnesium 1.2-1.7% Minor Impurities Remainder Aluminium	14		This material is very useful for the manufacture of castings where strength is required at elevated temperatures. It is a very strong alloy with high Brinell and it is particularly useful for internal combustion engines, pistons, cylinder heads, etc. Better as a die than sand casting. Solution heat treatment, quench in boiling water and leave for four hours.

SIMPLE POINTS OF DESIGN

Now that we have covered a little ground relative to the different characteristics that can be expected in various alloys, bearing in mind the analysis and heat treatment, if called for, let us consider the application of this information as regards design.

The choice of the material, the purpose for which it is required and the design of the component must inevitably be considered at the same time, each one affecting the other, and it is the results of the combination of these three in a properly balanced form which make for efficiency and satisfaction in the final design.

Difficulty is always experienced in a foundry when patterns or dies are supplied by customers with instructions to make a number of castings in a certain alloy, the equipment often proving unsatisfactory for economical manufacture by the particular methods employed by the foundry. This frequently involves the employment of unnecessary complicated foundry technique, with perhaps a subsequent high percentage of scrap resulting in a high price. In the case of dies it is difficult to modify them to adapt an alloy for which the apparatus was not originally designed. This applied to many dies a few years ago, when, owing to shortage of certain materials, substitute alloys had to be used. Runners and feeders had to be modified and in some cases dies had to be entirely re-made for use with the new specification called for.

Section thicknesses must be adequate and be such as to allow a ready flow of metal to all parts of the mould and the necking of intermediate sections which would tend to restrict this flow should be avoided. Heavy sections adjacent to thin ones are also unfavourable and the thin sections should be arranged in proportion to the heavy ones or the heavy sections reduced. This can be done in a number of ways. Bosses could be cored out providing sufficient taper is allowed or, in the case of bosses necessary on internal walls, these could be lightened out from the outside, this being specially necessary where they are situated in a remote part of the casting where feeding direct on to the section cannot be done.

Adequate radii must be used where possible, not only to obviate cracking while cooling in the mould, but also to distribute the stresses more evenly over a larger area when the casting is in use. Taking a case of a simple angle fixed on the base and subject to stresses at right angles to the fixed plane, the metal on cooling will crystallise at right angles to the plane and at the point of intersection of each a line of crystal weakness will be formed. This can be avoided by radiusing at corners and thus avoiding a cleavage plane. This principle should be applied in general to all intersections and in designing web, wall and boss junctions. This inside radius being in tension distributes the strain and would tend to neck in similar to a test bar when highly stressed. Whilst this is a simple point it must not be passed over too lightly as it is fundamental to efficient foundry practice. Even in these days it is often necessary for dies to be returned to the Tool Room for sharp corners to be eased owing to trouble with castings cracking in the mould, or when stressed in subsequent machining operations. Where a sharp corner is essential at a local point it is sometimes better to machine or file away the cast radius so as to ensure a sound casting in the first place.

The design of the casting should be as simple as possible, allowing generous tapers for extraction of cores, two degrees being fairly satisfactory.

If a parallel wall is required for a location or bearing surface it should be stated on the drawing and a good taper allowed for on the opposite wall to compensate. Avoid undercuts or internal projections to eliminate multi-piece cores which take longer to operate and are expensive to maintain. It is not practical to lay down a minimum thickness for walls as this depends on the size of the casting and the surface area, and the adjacent maximum thickness required, but as a general guide it is not advisable to specify below $\frac{1}{8}$ " even on a simple design and using a high fluid alloy such as 2L33.

The ideal design, of course, is for the metal in the casting form to cool together with the feeders being kept alive until this has

taken place. This unfortunately is very difficult to achieve in practice. For the most part we have chiefly considered the design from the foundry point of view and not from the mechanical aspect; the Designer has other considerations to bear in mind, especially if replacing an existing part made in cast iron by a light alloy casting, the most important being lower modulus of elasticity for light alloys. This is in the region of 10×10^6 pounds per square inch.

In cases where the casting is subject to stresses which tend to distort it and it is essential that it be rigid for design reasons, it will be necessary to increase the sections to give a higher section modulus. It is clear that for a given load the elastic deformation of an aluminium alloy will be about $1\frac{1}{2}$ times that of cast iron and extra strengthening is needed to be comparable. On the one hand, a slight distortion may regularise the stresses through the general body of the casting without vital interference with its objects but in certain instances, when in a key position, it may effect the working of adjacent parts and be unsatisfactory. The comparatively low yield point of aluminium alloys must also be borne in mind.

Where flanged castings are held together to provide oil-tight joints, these should be thickened up or webbed to give the necessary stiffness. Bosses should also be larger in diameter than is normally necessary for cast iron, so as to distribute the load over a larger area. Centres of bolt holes should be arrived at bearing strength and rigidity of the section in mind. It is usually preferable to bolt aluminium parts together by means of studs or bolts rather than use set screws, especially if the parts have to be disassembled at intervals for cleaning or other purposes. Aluminium threads tend to wear if subjected to too much stressing and friction. Threads should also be tapped to a good depth, about twice the diameter of the stud. It is practicable, of course, and advisable in certain instances to cast steel or brass inserts into the casting where the use of a thread is part of the function of the design. To sum up, therefore, the following points are the chief things to bear in mind when designing for aluminium:

- (1) Section thicknesses must be adequate to allow ready feed to all parts of the mould and must be as uniform as possible.
- (2) Adequate radius must be allowed at all web wall and boss junctions to prevent cracking, also to give smoother flow of metal into mould cavity.
- (3) Generous tapers must be provided internally for the extraction of cores and on outside projections to prevent binding on external parts of the casting. Undercuts which lead to multi-piece cores or sand cores should be avoided,

as both increase the cost of the article. Choose a simple design where high strength, hot short materials, are to be specified.

- (4) Design adequately, using large radii to blend out abrupt changes of section for strength purposes, bearing in mind the lower modulus of elasticity and proof stress given by light alloys.
- (5) In cases where pressure tightness is required, do not design walls too thin.
- (6) Use deep threaded studs or bolts, rather than set screws for clamping together points which have to be dissembled fairly frequently.

SIMPLE DIE DESIGN

When the drawing is received from the customer for quotation purposes, this is passed along to the die designer for estimating the weight of the casting and making a rough sketch of the proposed die design, from which is estimated the quantity of castings which can be produced per day in the foundry, and so back to the estimating department, who, on the information received, submit to the customer the part cost of the equipment and price of the casting. The die designer's first considerations, therefore, must be :

- (1) The quantity of castings called for and the alloy to be used. This information is required to assist the designer to put forward a design for the die so that the part cost of this would be economical when amortised over the total quantity of the castings called for. For instance, if 1,000 castings only are called for a single impression die would probably be advised, so as to keep the cost as low as possible. On the other hand, if 10,000 castings are called for, the designer most probably will provide a multi-impression die which will not only reduce the cost of the casting, owing to the more rapid production, but will more readily absorb the higher cost of the tool charge over the larger quantity. This would result in a cheaper price per piece.
- (2) The complexity of internal coring has to be considered to see whether it is possible to have an all steel core. Even if the core is to be made in several pieces for the convenience of extraction it is preferable to a sand core for various reasons. One of the drawbacks to using sand cores is the finish, especially where it is necessary for the wall surface to be smooth, and another is the fact that it may leave a fine sand residue which it is essential to clean away, as in the case of pump components. There is also the difficulty in dispersing the gas from the core caused by the flow of hot metal. In the case of sand castings this gas will flow

through the rather porous mould, but when enclosed by the steel die it has less opportunity and is normally forced back through the core. If this is not done efficiently the gas will force its way through the light metal, causing porosity and blow holes. It is possible, of course, to use a green sand core with a natural bond where less gas is formed, but these are rather delicate to handle in the foundry and tend to lose their sharp form and accurate shape. In the case of a sea sand core this is much easier to handle, being harder, but is liable to give off more gas owing to the special bonding agent used. The cost of the casting also is higher due to the fact that the separate operation in the making of the cores, baking, etc., has to be allowed for and a high standard of accuracy has to be maintained. In the case of a multi-piece core this takes longer to extract and there is fairly heavy maintenance in keeping the adjacent edges sharp so that junction lines do not show up badly on the casting.

- (3) The next consideration is how the casting is to be fed to give progressive solidification. There are two main ways of doing this ; one is to feed the metal in at the furthest part from the heavy sections. This is done so that the temperature of the metal is reduced by the time it has been fed through the die and round the heavy section and thus reduces the crystallisation shrinkage at this point. This will give a sounder casting and smaller grain size at the heavy sections, and also progressive solidification. The other way is to feed in at the heavy sections so that as the casting cools, live metal is fed into the heavy section to make up for the loss of volume which would normally occur in changing from liquid to solid. In this particular case, whilst the heavy section would be sound, the slower cooling would give a larger grain size and the sections would not be so strong as in the case of the first method.
- (4) The splitting of the die naturally depends on where the casting is to be fed and also where it is easier to pour, owing to the outside contour of the casting. This is very often complicated as it is not always possible to feed at a spot which is convenient to the splitting of the die. Apart from this we have to consider the die machinist, and design in such a way that the various awkward contours can be machined in the simplest manner with the machines at his disposal. Sometimes it is necessary to divide the die into a number of pieces for machining purposes and then bolt together into a unit.

- (5) Fettling of the casting, that is the removing of runners and risers, has to be considered so that this is a fairly simple operation and it is better to include these on a flat face which can be reached easily with a bandsaw, or on a face which has to be subsequently machined as called for by the designer. The question of time taken for fettling is very important as the time cycle for producing a casting can be considerably increased and a gain made by high casting production can be lost if the fettling operation is awkward and costly.

It is important that the gates are designed so as to admit the metal as gently as possible and free from turbulence, to avoid oxide inclusions and trapped air. Dies are normally made of close grained cast iron although steel is used in the case of multi-piece cores. The advantage of steel cores is that they can be rebuilt at the corners by welding, which is difficult to do in the case of cast iron. This is necessary as the corners gradually wear and form a flash line which looks unsightly and obstructs the cores in their removal. High grade steels such as chrome vanadium are sometimes used for small and delicate cores, as these would not normally stand up to the conditions imposed upon them in lesser grade materials.

It is necessary when dimensioning the die to make a contractional allowance so that the castings at normal temperatures will be the correct size. This varies in normal designs from between .006 to .008 per inch. Clearances must be arranged so that the die will work easily when hot. There must be no undue slackness, however, which would produce inaccuracy in the finished casting or allow metal in the form of flash to penetrate between the die sections. Lever slots are normally provided for opening the dies and in the case of large dies with heavy parts, the movement can be eased by racks and pinions or air cylinders. This, of course, is rather costly and depends upon the number of castings called for.

From the above notes it will be seen that the die designer has a big responsibility in designing and producing a die which is to work easily and efficiently to provide rapid production of castings which are sound and satisfactory to the customer. Not only do these have to be dimensionally accurate, but sound and of a good finish and any concession asked for by the Designer to make his burden easier should have every consideration by the Production Engineer.

PRODUCTION OF A CASTING

We will assume that the die is now made, has been checked over in the Inspection Department and is ready to go into the Foundry for producing the sample casting, which is normally sent to the customer for approval before proceeding with the bulk order.

The die is first heated up, care being taken that this is done

gently otherwise there is a danger of distortion and cracks developing. The internal cavity and the cores are sprayed with a die dressing which consists mainly of a preparation of talc and water glass. This is put on evenly so as to give the castings a good finish and also to protect the die from the erosion of the aluminium. The dressing dries almost instantaneously on the hot die. The die is then assembled. In the meantime the aluminium alloy ingot must be smelted in a convenient furnace, those mostly used being of the bale-out type. Care must be taken that the metal is not overheated; the temperature should not exceed 800°C . The casting should be poured at the lowest possible temperature, consistent with the metal, and properly filling the mould cavity. Great care must always be taken to ensure that the ladle is dry before dipping into the hot metal and most foundries after using the ladle put these on the side of the furnace to keep it hot. The clean metal, having been fluxed and made suitable, is ladled from the furnace and poured evenly and smoothly into the die by way of the ingate, and left to solidify. The metal will quickly freeze but the die is not opened until the gates and feeder heads have solidified. Small round cores are then withdrawn to relieve stresses in the casting and the main core is then extracted. The outside of the die is then opened and the casting exposed for removal. This sequence of operations is repeated. It may be necessary to make a number of castings to obtain a correct working temperature of the die before good castings are produced, and proper technique and optimum time cycle general for the type of casting is obtained. Certain adjustments may be necessary to size of gates, thickness of die dressing, alteration of metal temperatures, etc., before production of good castings is going smoothly.

Every job has its own teething troubles and various adjustments have to be made to overcome misruns, porous patches, blow holes, etc. The ordinary bale-out type of furnace is very popular for this work and a plumbago or carborundum crucible is generally used, but these have to be used carefully to give a good life. Cast iron pots are sometimes used but these have to be heavily coated to prevent erosion by the aluminium, which ultimately eats them away with the result that a certain amount of iron is picked up in the aluminium which, in the use of certain alloys, is not to be recommended. At the same time the heat transfer is more rapid through iron crucibles than the plumbago, especially when most of the plumbago has been burnt out of the pot leaving the refractory base. The reverberatory type of furnace is usually used for melting larger batches of material, which is relayed to the bale-outs for direct use in pouring the castings. On the larger type of die it may be necessary to use three or four men, pouring simultaneously so as to get the metal into the die more quickly over the larger area

and also to even up the heating of the die. After the casting is extracted from the die, it is allowed to cool and then sent along to the Fettling Department to have the feeders and excess metal removed, and to be filed and cleaned to comply with the drawing. The casting is then passed along to the Inspection Department.

INSPECTION Samples are first normally coloured or whitened and marked up in the Inspection Department, so that an accurate dimensional check can be made with the drawing. This casting is usually sent to the customer for his approval. Examination of castings in bulk production is then considered and in certain cases jigs are made for accurate checking, especially of large castings. Castings are checked for soundness, those having blow holes, porous patches, etc., being returned to the foundry for remelting.

Cracks and minute faults are detected by a powerful magnifying glass, the Glo-crack system, or X-ray. In the Glo-crack system the casting is heated up in a tank, using immersion heaters, the fluorescent liquid used penetrating into cracks and crevices. The casting is then washed off in a hot bath and allowed to dry. In the dark room, under a neon lamp, the fluorescent residue gives off a phosphorescent glow in the shape of the defect; this is ringed round with pencil by the operator as it cannot be seen under ordinary natural light. Another method is to heat up the castings in a mixture of oil and paraffin, dry off in sawdust, then cover with a coating of chalk. The casting upon cooling will exude this oil mixture and discolour the white chalk. X-ray, of course, is used for the inspection of Class I or Class II castings for aircraft, as it is possible by this method to see internal defects which otherwise cannot be revealed. Cracks, porosity, shrinkage, blow holes, etc., can be seen by this method, both on the X-ray screen or by means of photographic negatives. Sometimes several shots have to be taken from different angles on the casting to get the desired depth of penetration required according to the thickness of the section.

The inspection of castings by X-ray was originally introduced on account of the necessity for a definite check as regards the soundness of castings for vital parts of aircraft, but since its introduction it is now used in wider commercial fields. It is of especial value for checking porosity, in the case of commercial productions such as fuel pumps, and in castings generally where the cost of the casting is low compared with the cost of machining. It is advantageous therefore, in certain instances to pay a little more for the casting and institute a percentage X-ray, to reduce machining expenditure per piece. Apart from this, X-ray can be used to

establish casting technique. Sample batches are made and then X-rayed until the technique is correct so that bulk production can commence on a firm foundation.

Mr. L. R. Carr wrote a paper called "THE QUANTITATIVE INTERPRETATION OF RADIOGRAPHS IN TERMS OF MECHANICAL PROPERTIES" which goes very deeply into the radiographic techniques, the main object being to show the definite correlation between radiographic evidence and mechanical properties.

This line of investigation opens a new field of development but it is one of personal experience and investigation. It can only be built up by experiment in actual cutting up or taking tensile tests from castings, which are carefully examined in conjunction with their radiographs.

MACHINING AND FINISHING OF CASTINGS It is not possible in the confines of this paper to discuss these items at length, as both machining and finishing of aluminium castings are specialised jobs. It could be mentioned, however, in connection with machining that there is a big difference in the machining qualities of various aluminium alloys. Those of the higher Brinell usually give a much better finish. The high silicon alloys as a rule are difficult to machine and do not give a really good finish. This depends greatly on tool technique, speeds, etc., and lubricants used. It is always essential that the edges of tools are ground carefully so as to eliminate a wire edge, otherwise a build-up of aluminium on the cutting edges is to be expected.

Tungsten carbide tipped tools are very popular for the machining of large repetition quantities of light alloy castings, and they are used in large quantities for machining pistons. They hold their size for much longer periods than ordinary high speed steels; the aluminium tending to be abrasive, they are normally sharpened on diamond-impregnated wheels to obtain the desired accuracy and fine finish required. The machining of aluminium is very much faster than cast iron as the cutting speed can be taken as high as permissible by the machine used to give the accuracy called for. High surface speeds with small feeds and cuts are preferable.

Lubricants usually used are paraffin and a mixture of paraffin and cutting oil, or sometimes suds oil.

In the tapping of threads more care has to be taken as there is always a danger of the threads tearing and well backed off ground thread taps should be used with a suitable lubricant. It is better for holes to be bored slightly in excess of standard Whitworth sizes, which would tend to produce a small flat on the tip of the thread. This helps to prevent tearing and does not weaken the threads. Diamond tools are used in the machining of pistons to give a very

fine finish, but it is essential that the castings supplied are free from oxide inclusions, otherwise very high charges for replacement diamond tools will be occasioned. This also applies to tungsten carbide tipped tools.

FINISHING

The majority of aluminium castings are used in their natural state but are sometimes anodised, polished, or enamelled as called for. In the case of anodising this is chiefly done :

- (1) to harden up the surface as in the case of pistons.
- (2) for corrosion resistance purposes.
- (3) followed by colouring for decorative purposes.

Most aluminium casting alloys will anodise to improve their corrosion resisting properties, but to anodise and colour for decorative purposes is a different story. Pure aluminium as normally seen anodised and coloured in sheet form is a very suitable application, but this cannot be applied with any great success to the general run of commercial casting alloys owing to the unsuitability of the alloying constituents for this purpose. The addition of silicon, for instance, gives a dull grey finish to the casting. It is not suitable for decorative purposes, and will not take any colour except black. The aluminium magnesium type of casting is more satisfactory but unfortunately casting technique is somewhat limited in complicated shapes. It is advisable, therefore, when considering decorative forms of anodising for an aluminium casting to consult the anodising specialist or see samples in the particular material chosen before going all out on production.

Aluminium will polish very well and is a very attractive finish. This process, however, is fairly costly especially if a high degree of finish is required. Simpler forms of barrel polishing can be used but this does not produce the polish which is obtained by using a sequence of emery bobs, finished off on suitably graded mops with tripoli, and white finishing composition. It is necessary to have a good skin finish on the casting otherwise this process is very lengthy. Die castings are far preferable to sand castings as the slightest surface defect will spoil the look of a polished article. Incidentally it is necessary to get a very high polished surface for satisfactory coloured anodising.

One of the best finishes on aluminium gravity die castings is the enamel crackle finish. This is very attractive in appearance and covers up slight defects, fettling marks, etc., and it is not necessary to polish the article before carrying out this operation. Anodising makes a very good bond for the enamel and stops undue flaking.

THE INSTITUTION OF PRODUCTION ENGINEERS

As regards polishing and plating, certain firms are now specialising in this and rapid advances in techniques are being made. It is advisable, therefore, to consider seriously the method of finishing at the outset and seek expert advice in order to save much disappointment and many headaches in producing the finished article.

(Reproduction of the photographs appearing on the following pages is by courtesy of John Dale, Ltd.).



FIG. 1. Corner of sand foundry.



FIG. 2. Sand casting in high strength alloy, D.T.D.300 Radius Rod for aircraft.



FIG. 3. Typical Die Castings showing saving of machining.

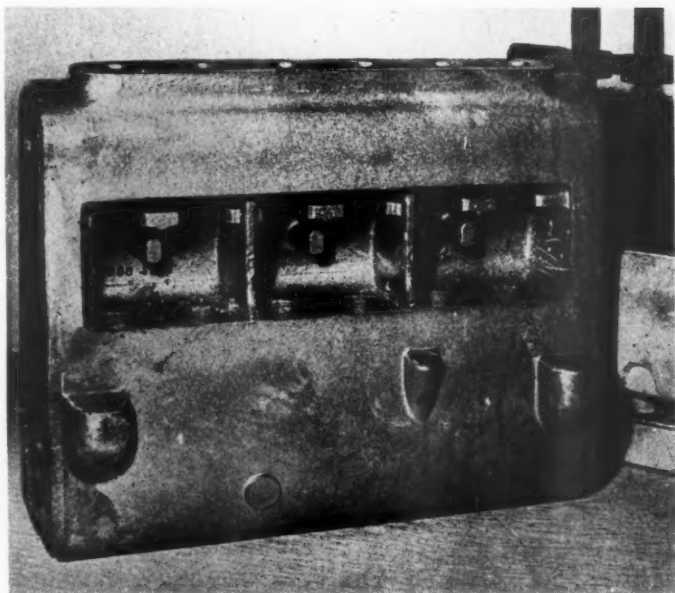


FIG. 4. Pump casting with sand core.



FIG. 5. Die with sand core.

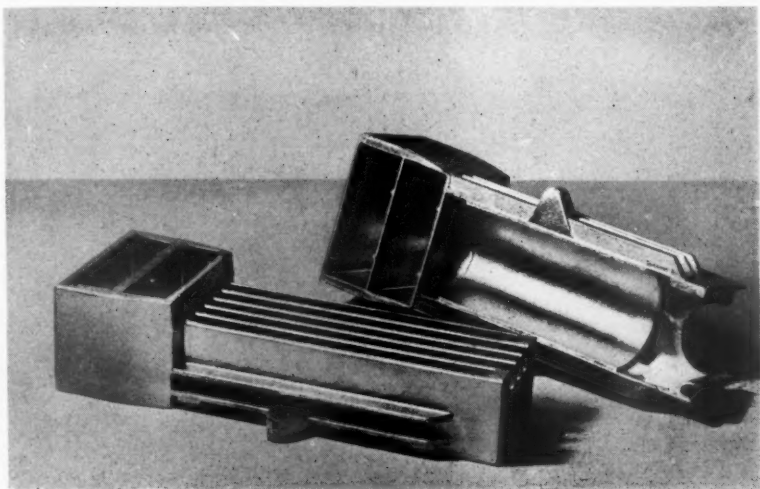


FIG. 6. Evaporator casting.

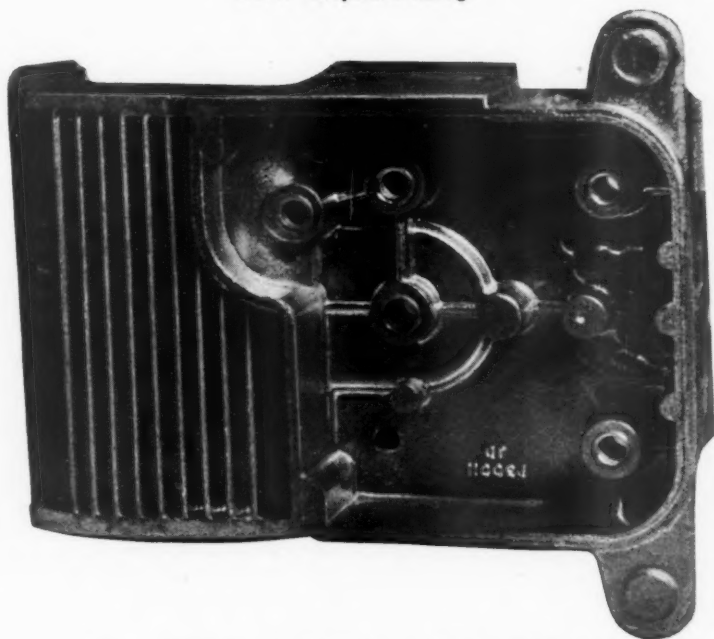


FIG. 7. Complicated casting made practical by attention to design.



FIG. 8. Evaporator casting being extracted from Die.

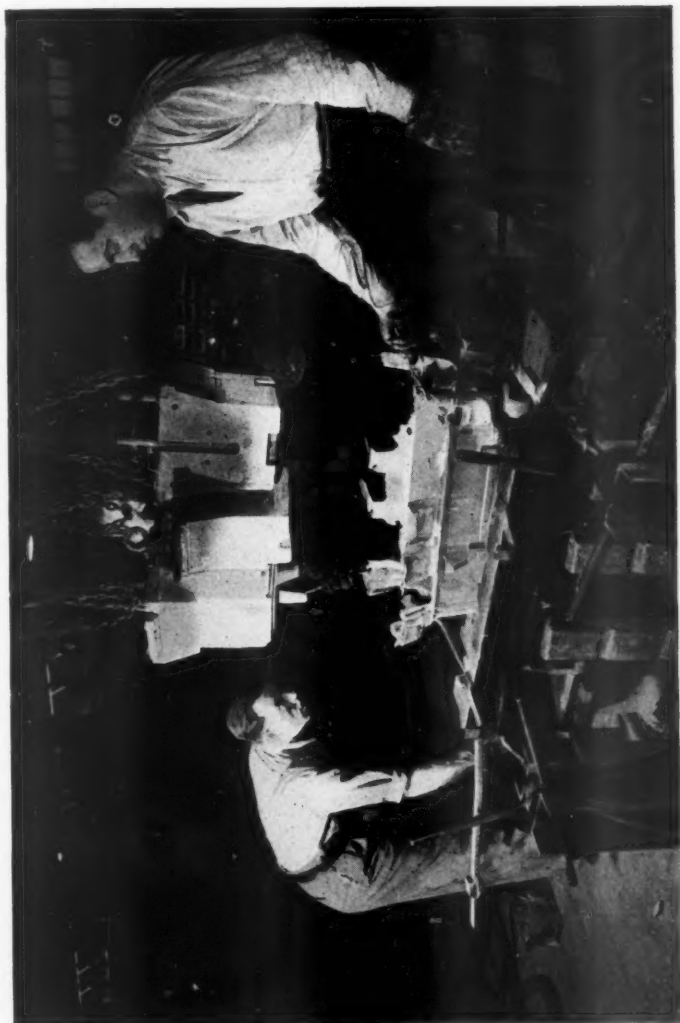


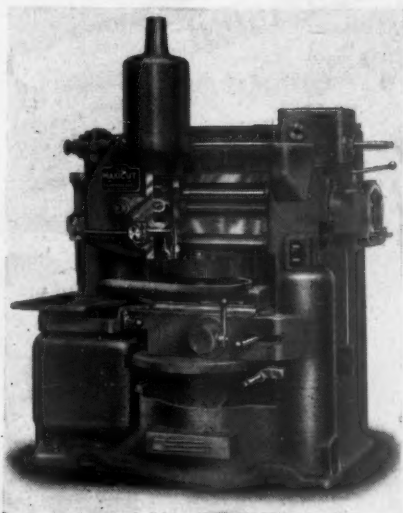
FIG. 9. Crankcase sump working a large Die.



FIG. 10. Inspection by X-Ray.

MAXICUT N^o 3A

HEAVY DUTY GEAR SHAPER



Write for
Catalogue
No. D.B.C. 200

This new Gear Shaping Machine with a capacity up to 18" P.C.D. has a new workspindle slide and combines great rigidity and accuracy over long periods

Controls make for effortless operation and quick change-overs

Production estimates gladly sent on receipt of your blueprints

MANUFACTURED BY

DRUMMOND BROS. LTD
RYDES HILL • GUILDFORD • ENGLAND

Sales and Service for the British Isles:
DRUMMOND-ASQUITH (Sales) LTD • KING EDWARD HOUSE • NEW STREET • BIRMINGHAM
Phone : Midland 3431-2-3. Grams : Maxishape, B'ham.
also at LONDON and GLASGOW.

HARRIS

ground thread
TAPS & DIES, GAUGES

the ultimate in

JOHN HARRIS TOOLS LTD.
MILLERS ROAD, WARWICK, Eng. phone: WARWICK 741 (4 lines)



PARSONS CHAIN CO. LTD., STOURPORT-ON-SEVERN, WORCS.

Excuse our enthusiasm
but to us
these
parts
are greater
than
this whole



ZINC CAN HELP in form room as well as factory. Thus it contributes essential parts to this globe,* produced in large quantities for home and export markets.

Why the parts are zinc alloy die cast

The pivots on which the globe revolves are die cast in zinc alloy (and would that world affairs went round as smoothly as this globe!) The thin meridian, too, is zinc alloy die cast, because zinc alloy is specially suitable for casting very thin sections, and the meridian can be made with raised degrees of latitude cast on it. Finally, the base is a zinc alloy die casting. The globe is made in $1\frac{1}{2}$ in. diameter (with other sizes to follow) and die cast parts are given a gilt finish.

Other educational uses

Zinc alloy die casting is also used for minutely accurate quantity production of microscope frames, projector parts, lantern parts, epidiascope parts, film viewers and drawing instruments.

Some facts about zinc alloy die casting

Speed is the essence of the die casting process — the shortest distance between

raw material and finished product. Zinc alloys are the most widely used metals for die casting because they ensure:

STRENGTH: Good mechanical properties for stressed components.

ACCURACY: Castings can be made practically to finished dimensions and need little or no machining.

STABILITY: Close tolerances are maintained throughout the life of the casting.

Hence the widespread war-time use of zinc alloy die casting for fuses, gun sights, periscopes, tank carburettors, etc.

British Standard 1004

Alloys conforming to B.S.1004 should be specified where strength, accuracy and stability are essential.

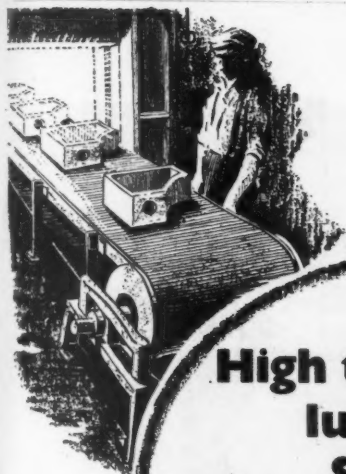
ZADCA

ZINC ALLOY DIE CASTERS ASSOCIATION
LINCOLN HOUSE, TURL STREET, OXFORD.
TELEPHONE: OXFORD 48068.

ZINC ALLOY DIE CASTINGS PLAY AN IMPORTANT PART IN THE EXPORT MARKET

Enquiries about the uses of zinc alloy die castings are welcome. Publications and a list of Members will be sent on request.

* Photograph by courtesy of George Philip & Son, Ltd.



High temperature lubrication SOLVED !

Working temperatures which burn oil or grease are nothing to 'dag' colloidal graphite. Swab it, paint it, spray it on hot moving surfaces it stays to lubricate.

It will also reduce wear, prevent seizure, ensure smooth, continuous running.

Longer life for moving parts is the result. Please send to us for full details.



colloidal graphite
will do it for you!

graphite at its finest

POST THIS COUPON TO:—

ACHESON COLLOIDS LIMITED.
9 Gayfere Street, London, S.W.1.

Please send Leaflet 63 and other information on dry lubrication with 'dag' colloidal graphite.

Name

Address



ACHESON COLLOIDS LIMITED
9 Gayfere Street, Westminster, London, S.W.1.

2361

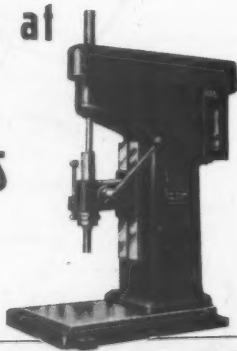


AJAX MACHINE TOOL
CO. LTD. · HALIFAX



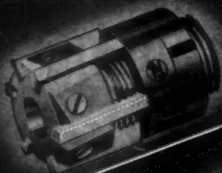
HOLES can be
exacting and expensive . . .
but for **EXACT** holes at
LOW cost
install **AJAX DRILLS**

★ We make a range of sensitive drilling machines from $\frac{1}{4}$ " to 1" capacity. Speeds up to 10,000 r.p.m. Bench and pedestal mounted.

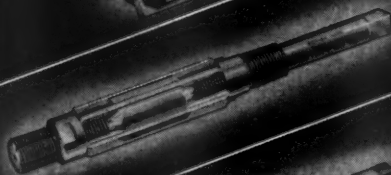


AJAX
MACHINE TOOLS

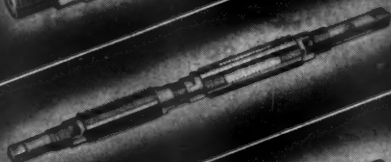
Known and used throughout the World



EXPANDING
THREE REAMER



EXPANDING
HAND REAMER



EXPANDING
PILOT REAMER



EXPANDING
M/C REAMER

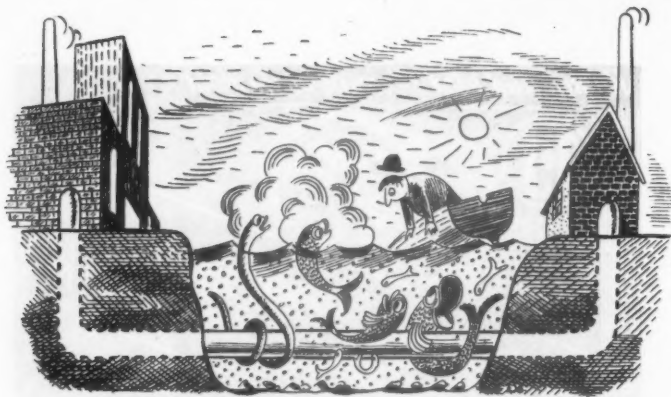


See Taylor MULTI
TOOL HOLDER

STANDARD BRITISH TOOLS • MADE IN ENGLAND BY

TAYLOR & JONES LTD

HONLEY • NR: HUDDERSFIELD



A well-built condensate return system, but only the fish got the benefit!

The management of a certain works went to great trouble to install a condensate return system, but were discouraged to find that they were still getting cold water to feed their boilers. The Ministry's Fuel Engineer, who happened to hear of their difficulty, discovered that the return main passed through a river on its way back to the boiler house. The result was a fine central heating plant for the local fish and an equally effective cooling system for the condensate which they had taken such care to collect.

This wouldn't happen to you!

Of course not. But it did happen to someone! And this is no isolated instance of the obvious

being overlooked. We all have our blind spots, and however familiar we are with an installation or a process, we are liable to pass over bad or out-dated practices that a fresh pair of eyes would spot in a moment.

Wouldn't you be wise to ask the Ministry's Fuel Engineer to pay you a visit—just in case? Not only is he rich in practical experience, but he can look at the job from a fresh point of view.

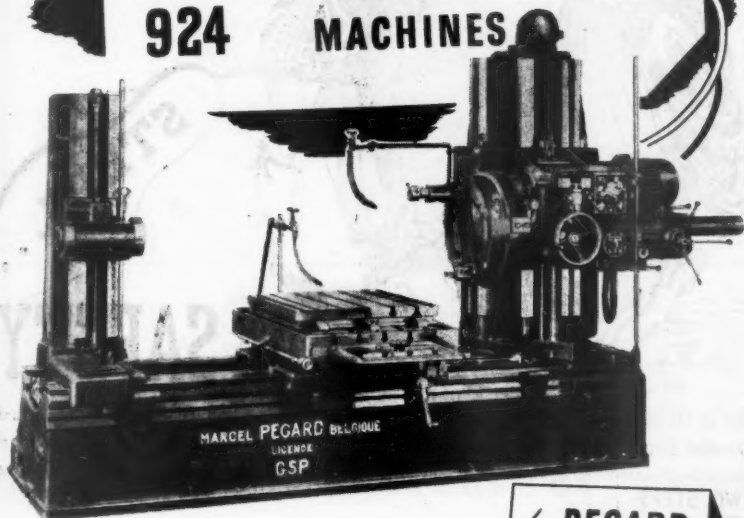
By the way, have you referred to "The Efficient Use of Steam" by Oliver Lyle? It can be ordered through any bookseller (886 pp., 15/- net), or obtained from H.M. Stationery Office, 15/9 post free.

YOUR REGIONAL FUEL OFFICE

REGION	ADDRESS	TELEPHONE
Northern	Government Buildings, Ponteland Road, Newcastle-on-Tyne, 5	Newcastle 28131
North-Eastern	Century House, South Parade, Leeds, 1	Leeds 30611
North-Eastern	Mount Pleasant School, Sharrow Lane, Sheffield	Sheffield 52461
North-Midland	Castle Gate House, Castle Gate, Nottingham	Nottingham 46216
Eastern	Shaftesbury Road, Brooklands Avenue, Cambridge	Cambridge 55268
London	Mill House, 87/89, Shaftesbury Avenue, W.1	Gerrard 9700
South-Eastern	Forest Road, Hawkenbury, Tunbridge Wells, Kent	Tun. Wells 2780
Southern	Whiteknights, Earley, Reading	Reading 61491
Wales	27, Newport Road, Cardiff	Cardiff 9234
South-Western	12/14, Apsley Road, Clifton, Bristol, 8	Bristol 38223
Midland	Temporary Office Buildings, Hegley Road West, Birmingham, 17	Bearwood 3071
North-Western	Burton Road, West Didsbury, Manchester, 20	Didsbury 5180-4
Scotland	145, St. Vincent Street, Glasgow, C.2	Glasgow City 7636
Scotland	51, Cockburn Street, Edinburgh, 1	Edinburgh 34831
Scotland	1, Overgate, Dundee	Dundee 2177

ISSUED BY THE MINISTRY OF FUEL AND POWER

New **HORIZONTAL BORING
MODEL MILLING & DRILLING
924 MACHINES**



by **PEGARD
OF BELGIUM**

Traversing Spindle $3\frac{1}{8}$ " diameter
with Automatic Facing Head to
face up to $31\frac{1}{2}$ " diameter.

FULL SPECIFICATION ON APPLICATION

**EARLY
DELIVERY**

SOLE AGENTS for Gt. Britain,
Northern Ireland and Eire:

GEORGE COHEN SONS & CO. LTD

SUNBEAM ROAD, LONDON, N.W.10 Phone: ELGAR 7222 7
STANNINGLEY, Nr. LEEDS - - - Phone: Pudsey 2241

ONE OF THE
600
GROUP

And at Birmingham - Newcastle - Sheffield - Glasgow - Dunfermline - Manchester
Swansea - Southampton - Bath - Belfast

Established 1834

JIFE/4810/MT61

..FOR USERS OF ZINC-ALLOY PRESSURE DIE-CASTINGS



Due to the change over from wartime conditions there is a considerable amount of secondary and re-melted Zinc Alloy in circulation . . . Inter-crystalline corrosion caused through an impurity content of even a few thousandths of 1% , endangers the life of your castings . Protect **YOUR** interests by taking **TWO STEPS**

STEP No 1

Specify Zinc Alloy Die-castings which conform to B.S.S. 1004.

STEP No 2

Contract to have a reliable metallurgical test carried out, as a routine monthly check on the specification of Zinc-Alloy Die-castings taken at random from incoming supplies .

WOLVERHAMPTON DIE-CASTING CO. LTD.
GRAISELEY HILL . WOLVERHAMPTON

Telegrams : DIECASTINGS, WOLVERHAMPTON.

Telephone : 23831/4 WOLVERHAMPTON



There are hundreds of parts that can be Centreless Ground

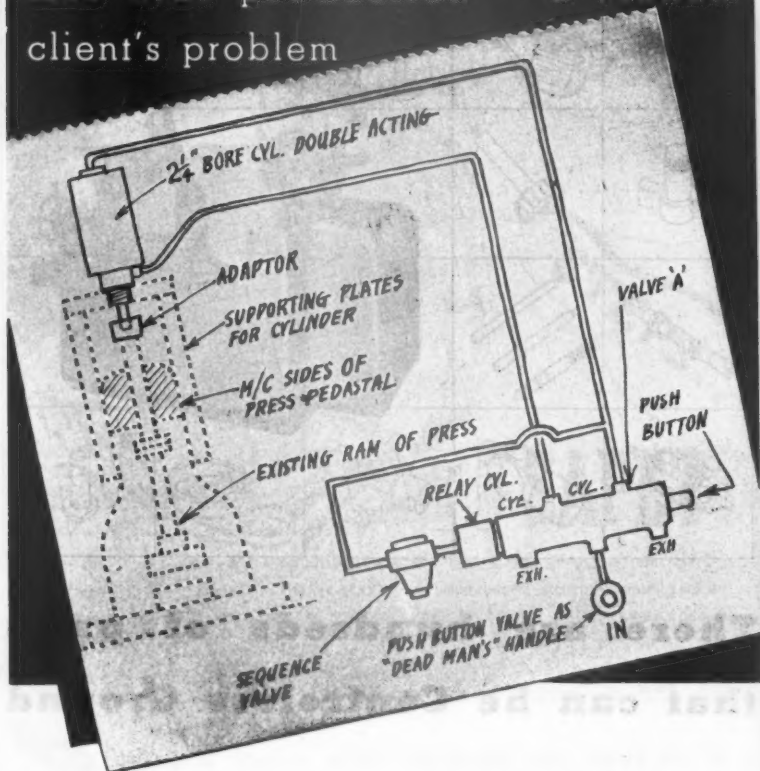
The Centreless method of Precision Grinding offers an unique approach to the solution of many otherwise difficult production problems. Cincinnati Centreless Grinders incorporate new time-saving features aimed at expanding still further the field of operation. Full particulars and specialist advice may be obtained upon request from

CINCINNATI

CINCINNATI MILLING MACHINES LIMITED, TYBURN, BIRMINGHAM

Sales Representatives for Eire: Booth Bros. Ltd., Dublin.

Air aids production — a Maxam client's problem



- FUNCTION.**
1. Operator presses both push buttons to operate press. Valve 'A' stays on.
 2. Sequence valve adjusted to operate relay cylinder according to timing required, this reverses action of valve 'A' which is reset and also returns cylinder to top position.

The possibilities of **MAXAM SPECIAL PURPOSE TOOLS** are practically unlimited. If you have a problem, send it to:—



CLIMAX ROCK DRILL AND ENGINEERING WORKS LIMITED
4, Broad Street Place, London, E.C.2.

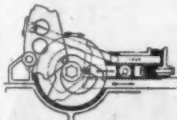
Works: Carn Brea, Cornwall



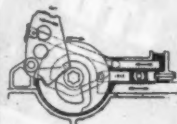
Wickman
AUTO POINTS

Accurate feed strokes for end-working tools are set by simply sliding the setting-block to the appropriate graduation on the scale attached to the quadrant.

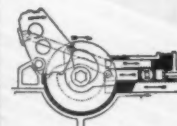
The pentagonal centre-block and two independent slides are actuated by pushers to which the motion of the quadrants is transmitted by racks and pinions, as shown below. Fixed cams, on the same shaft, actuate a fast return and approach motion by means of slides on which the rack pinions are located.



Slides in back position. Pinion carrier about to advance, giving constant approach stroke.



Approach stroke completed. Pinion carrier secured between cams and stop screws.



Working stroke completed.

**He'll set all feed strokes
in 5 minutes on the
WICKMAN**

MULTI-SPINDLE AUTOMATIC

Because there are no cams to change!

An Allen Key, a flick of the wrist and 5 minutes are all that are required to set all feed strokes on the Wickman Multi-Spindle Automatic.

No cam-changing. No cam-stocking. No cam-making. Think what this means in substantial overhead savings and quick change-over! And because changes from one component to another can be made in a fraction of the normal time, the use of Multi-Spindle Automatics becomes economical for short run jobs.

Wickman Multi-Spindle Autos are available in the following sizes: $\frac{7}{8}$ ", $1\frac{1}{8}$ ", $1\frac{3}{4}$ " and $2\frac{1}{4}$ " for bar work; 5" and 6" for chucking work.

Write for literature and examples of quick change-over on Wickman Multi-Spindle Automatics today.

Wickman
for

A. C. WICKMAN LTD • COVENTRY • ENGLAND
LONDON • BRISTOL • BIRMINGHAM • LEEDS • GLASGOW
MANCHESTER • NEWCASTLE • BELFAST

Automatics

m

A

ress.

ning
urns

Q

T

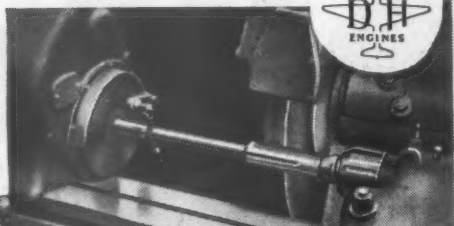
ED
wall

437

PRECIMAX

GRINDING PROPELLER ADAPTOR TUBE FOR

Typical of many jobs which are PRECIMAX ground at the de Havilland Aircraft Co. Ltd., is this copper adaptor tube, on which limits as close as 0.0002 in. are easily held. If your work calls for close limit grinding at maximum rates, let us tell you about PRECIMAX grinders.



JOHN LUND LTD
Crosshills, Keighley, Yorks, Eng.

MAINTAINED BY

JOHN LUND, LTD., CROSSHILLS, KEIGHLEY, YORKS.



BSA

High Class—Dependable.

SMALL TOOLS AND WORKSHOP ACCESSORIES

TRADE MARKS

B.S.A.

MILLING CUTTERS.	DIE STOCKS.
TWIST DRILLS.	SLEEVES AND SOCKETS.
CENTRE DRILLS.	QUICK CHANGE DRILL CHUCKS.
REAMERS.	LATHE CHUCKS.
ADJUSTABLE REAMERS.	MACHINE VICES.
DRILL REAMERS.	COOLANT PUMPS.
CUT THREAD AND GROUND THREAD TAPS.	HACK SAW BLADES.
TAP WRENCHES.	FILES AND RASPS.
DIES.	BROACHES.

B.S.A. TOOLS LTD.
BIRMINGHAM
ENGLAND

M O D E R N



SELF-OPENING STUD SETTERS



● The ONLY Tool to include all the features that contribute to fast and efficient stud setting.

● Studs are driven to a predetermined setting when driving jaws open.

● Operated by ANY portable tool or in a drill press.

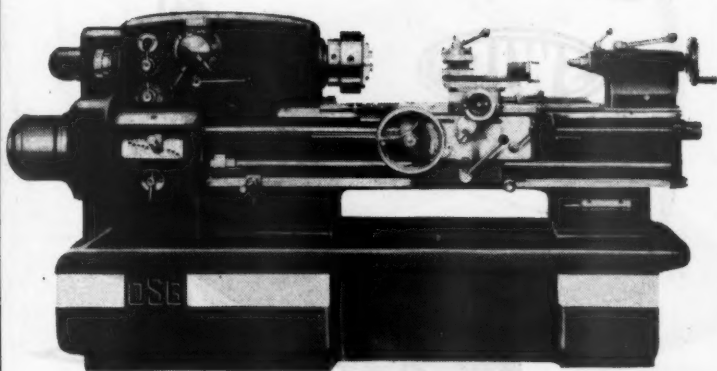
TWO SIZES — CAPACITY $\frac{3}{16}$ in. TO $\frac{7}{8}$ in.

CATMUR MACHINE TOOL CORPORATION LTD

WHITEHEAD HOUSE, 247-9 Vauxhall Bridge Rd., LONDON, S.W.1

Telephone : WHitehall 0094-5 (Extn. 4 Mr. Langley)

For High Class Production
or Toolroom Work
TYPE 13



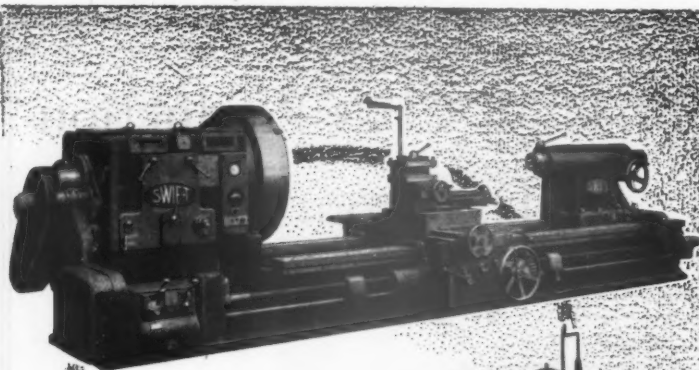
13" SWING PRECISION LATHE.

from our
New Range
13" to 30" Swing

Flanged Vee Rope Motor Drive
Self-Adjusting Clutch
Middle Bearing to Spindle
Final Drive to Spindle by Vee Ropes
Patent "Fastlock" Spindle Nose
Wide Range of 12 Spindle Speeds
Wide Range of Threads

CATALOGUE and
PARTICULARS on request





LATHES



Leadership in Lathes
Perfection in Planers

SWIFT LATHES are built as both Centre Lathes and Surfacing and Boring Lathes, and range from 17in. swing to 72in. swing, with any length desired between centres.

SWIFT-SUMMERSKILL PLANING MACHINES are built from 2ft. 0in. square up to 5ft. 0in. square, of any length of table up to 40ft. 0in., of both Double Column and Openside types, with either all Electric or reversing Two Belt Drive. Special All Electric Feed Motion.

GEO. SWIFT & SON LTD.

CLAREMONT WORKS • HALIFAX • ENGLAND

*A new edition
of this Catalogue
is just off
the Press*



*Write for
your copy
Today*

MACHINERY SHOWROOMS

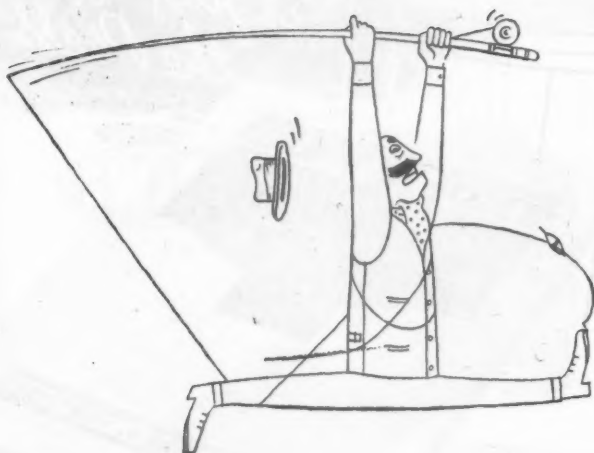
SHEFFIELD: Albion Works and Templeboro'
LONDON: Thames Road, Silvertown, E.16
GLASGOW: 18/24 Fore St., Scotstoun, W.4
BRITON FERRY (Glam): Giant's Wharf
GRAYS (Essex): Titan Works

★
*Remember - WARDS
 might have it!*

THOS. W. WARD LTD
ALBION WORKS, SHEFFIELD

London Office: **BRETENHAM HOUSE, LANCASTER PLACE, STRAND, W.C.2.**

Castability



Ease and speed of casting are accomplishments the fisherman aspires to and the MAZAK user achieves.

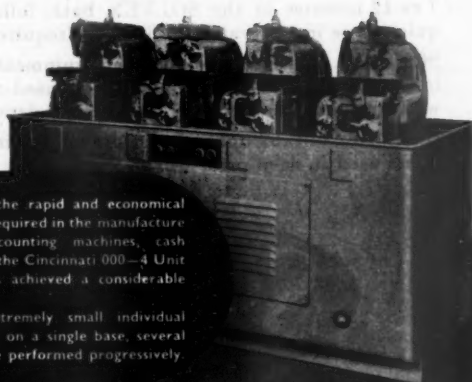
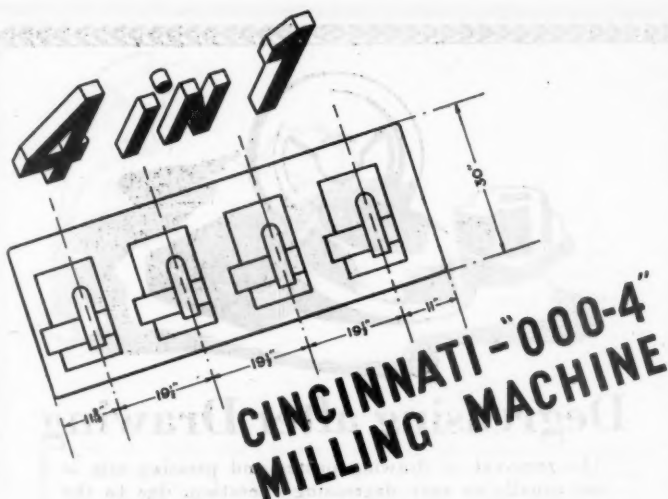
There is practically no limit to the complexity of shape which can be die cast in MAZAK Alloy (B.S. 1004), carburettors and mortise lock parts being examples.

MAZAK's castability is combined with great strength. Because MAZAK is based on 'Crown Special' Zinc of 99.99 + % purity, inter-crystalline corrosion — causing distortion and disintegration — has been banished. Every batch of MAZAK is spectrographically examined.

Other advantages include high tensile and impact strength; ductility; durability; corrosion-resistance; low finishing cost and ease of plating. When such qualities are essential, use or specify MAZAK alloy, which provides the optimum combination.

MAZAK

IMPERIAL SMELTING CORPORATION LTD. 37 DOVER STREET LONDON W.1



Designed specially for the rapid and economical production of small parts required in the manufacture of sewing machines, accounting machines, cash registers, small tools etc., the Cincinnati 000-4 Unit Type Milling Machine has achieved a considerable popularity.

Consisting of four extremely small individual milling machines mounted on a single base, several different operations can be performed progressively.

CHARLES CHURCHILL & CO. LTD.
COVENTRY ROAD, SOUTH YARDLEY, BIRMINGHAM



Degreasing after Drawing

The removal of drawing pastes and pressing oils is not usually an easy degreasing operation, due to the tenacious nature of these compounds. With SOLVEX, however, the operation can be done quickly and without holding up production. Simple immersion for 7 to 12 minutes in the SOLVEX bath, followed by a quick rinse in hot water is all that is required.

SOLVEX requires no elaborate equipment, is non-inflammable, non-toxic and can be used repeatedly without losing its efficiency. Write for details.

N.B. Not suitable for paste media containing mineral fillers used in deep press work.



FLETCHER MILLER LTD., HYDE, Near MANCHESTER, ENGLAND

On Air Ministry, Admiralty and War Office Lists. Full inspection to A.I.D. and A.R.B. requirements

Distributors in Northern Ireland:

BELL'S ASBESTOS and ENGINEERING LIMITED, 21, Ormesau Road, Belfast.

Telephone: Belfast 21068

Distributors in Eire:

A. H. MASSER LIMITED, Annesley Works, East Wall Road, Dublin.

Telephone: Dublin 76118.



"Pieaster meetyer, Prof."

Will Might, the Mill-wright
— and the PROF.
Set-too, No. ONE

"I regret, Mr. Might, that I cannot be equally effusive. I rate men like you no higher than grub-screws. It could be little pleasure to me even were you worth meeting, which you are not."

"That's O.K. with me, Prof. We practical men think you're nuts, anyway—nuts rusted up, rounded-off with the wrong size spanner, immovable 'cept with a hack-saw. It's good to start by knowing one another, ain't it old cock?"

"I dislike you intensely, my man,

but find your rudeness stimulating. As I understand it, we are to form a two-piece brains trust in this series of advertisements. We will speak fearlessly to one another. I represent brains and you represent brawn—if I may coin a phrase. But don't call me old cock."

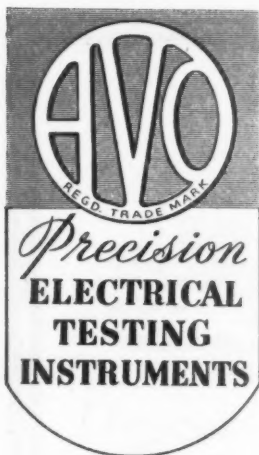
"No, old cock, I represent practical experience and you, theory. But we will agree on one thing. I always use Hendrys' Belts, and you always advocate their use, although as far as you know belts are used only to keep pants up."

Hendrys'

BELTING

JAMES HENDRY LIMITED
LAMINATED LEATHER WORKS
252 MAIN ST., GLASGOW, S.E.

LONDON: KINGSWAY HOUSE, KINGSWAY, W.C.2
ABBEY HOUSE, 63 HOCKLEY HILL, BIRMINGHAM 18
MANCHESTER — and — JOHANNESBURG



PRICE

£19 : 10s.

Size : 8" X 7½" X 4½"
 Weight : 6½ lbs. (including leads)

Sole Proprietors and Manufacturers :

The AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
 WINDER HOUSE • DOUGLAS STREET • LONDON • S.W.1 Telephone: VICTORIA 3404/9

The Model 7 Universal **AVOMETER**

The world's most widely used combination electrical measuring instrument. It provides 50 ranges of readings on a 5-inch hand-calibrated scale fitted with an anti-parallax mirror, and is guaranteed accurate to B.S. first-grade limits on D.C. and A.C. from 25 c/s to 2 Kc/s.

The meter will differentiate between A.C. and D.C. supply, the switching being electrically interlocked. The total resistance of the meter is 500,000 ohms.

CURRENT : A.C. and D.C. 0 to 10 amps.

VOLTAGE : A.C. and D.C. 0 to 1,000 volts.

RESISTANCE : Up to 40 megohms.

AUDIO-FREQUENCY POWER OUTPUT :
0 — 2 watts.

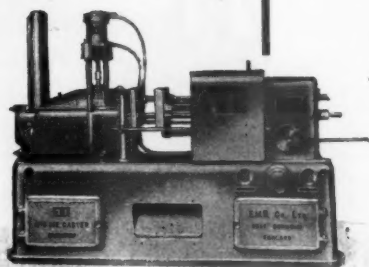
DECIBELS : -25Db. to +16Db.

The instrument is self-contained, compact and portable, simple to operate and almost impossible to damage electrically. It is protected by an **automatic cut-out** against damage through severe overload.

Various accessories are available for extending the wide ranges of measurements quoted above.

Write for fully descriptive pamphlet.

The large demand for
E.M.B. No. 6 Die Casters
has necessitated special arrange-
ments to increase production.
In consequence
we are now able
to offer much
earlier delivery



No. 6 PATENT DIE CASTER

FEATURES

- ACCURATE TEMPERATURE CONTROL
- HIGH OUTPUT
- LARGE FURNACE CAPACITY
- SINGLE LEVER CONTROL
- INTERLOCKED SAFETY GUARD

CAPACITY

HORIZONTAL DISTANCE BETWEEN BARS $8\frac{1}{2}$ in.
MAX. & MIN. DIE THICKNESS 7 in. — 2 in.
MOVEMENT OF PLATEN $4\frac{1}{2}$ in.
WEIGHT (INCL. SPRUE) per shot up to 12 ozs.
SPEED OF OPERATION up to 20 shots min.

E.M.B. Co. Ltd.

WEST BROMWICH ————— ENGLAND

E.M.B.

**HERBERT**

HIGH-SPEED INSPECTION

SIGMA MULTI-DIMENSION INSPECTION MACHINES—A REVOLUTIONARY DEVELOPMENT IN THE INSPECTION OF MASS-PRODUCED PARTS.

100% inspection of all essential dimensions on parts up to 4" diam. \times 8" long.

All sizes checked simultaneously, the result being shown instantly by signal lights.

Three types, Hand-operated, Semi-automatic and Full-automatic
Many installations are in successful use.

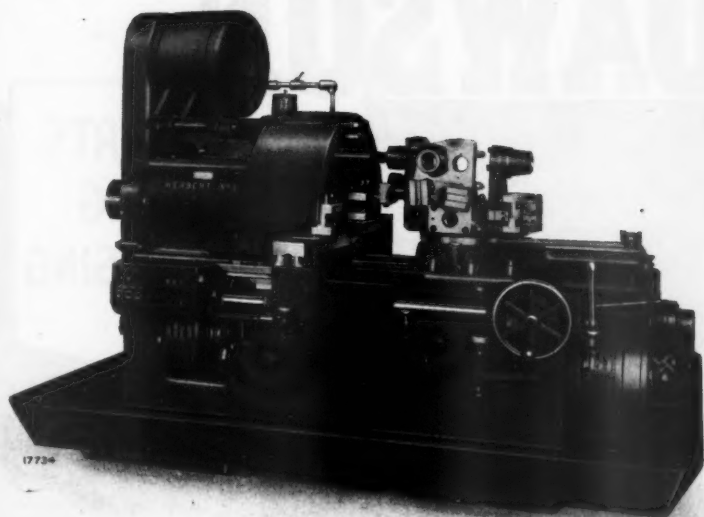
All three types can be seen in operation at our Works.

Sole Agents :

ALFRED HERBERT LTD · COVENTRY



HERBERT



No. 4 AUTO-LATHE (SPLASH GUARDS OMITTED)

HERBERT AUTO-LATHES

High production Automatic Chucking Machines, made in four sizes, for using carbide tools to the fullest advantage.

FLAMARD beds and capstan slides, 478 to 555 Brinell, in conjunction with roller-bearing spindles, effectively preserve alignment.

Self-selecting feed motion greatly simplifies setting.

Independent cross slides operate either together or at different times during the cycle.

Air or electrically-operated chucks reduce idle time.

Machine	Swing	Delivery
AUTO-JUNIOR.....	6"	6 weeks
No. 3A AUTO-LATHE.....	9"	24 weeks
No. 4 AUTO-LATHE.....	16½"	10 weeks
No. 5A AUTO-LATHE.....	25"	26 weeks

CATALOGUE ON REQUEST

ALFRED HERBERT LTD · COVENTRY

DAWSON

CUTTING PRODUCTION COSTS

This Dawson machine is washing, rinsing and drying thousands of aluminium and steel containers every day—saving time, labour and costs and allowing a steady flow of work without pause or bottleneck in the production line.

Dawson Metal Parts Cleaning and Degreasing machines are in operation in all kinds of engineering works, cleaning everything from small nuts and bolts to complete aero engines and motor buses.

METAL PARTS CLEANING *and* DEGREASING PLANT

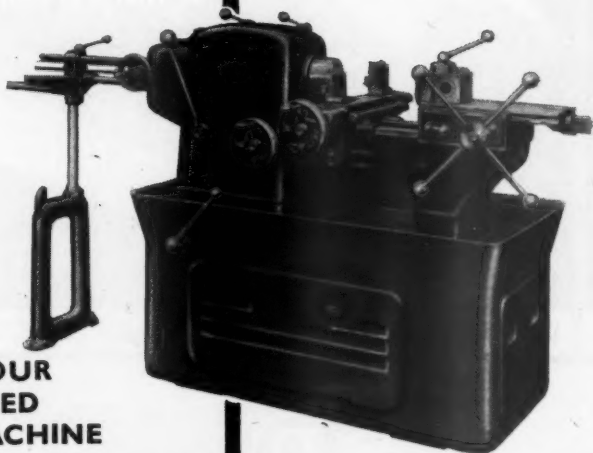
Manufactured by DAWSON BROS. LTD., GOMERSAL, LEEDS.

Sole Distributors & Consultants :

DRUMMOND-ASQUITH (SALES) LTD.

King Edward House, New Street, Birmingham.

No. 2 Capstan lathe.
Bar Capacity up to 1"
diameter.



THE HOUR THE NEED THE MACHINE

This new capstan lathe definitely gives faster production. Relatively few moving parts, some of light alloy, permit extremely fast starting, stopping and reversing movements which are foot controlled to free operators' hands. Capacities up to 2" bar dia. Built-in motor and electrical controls.

- ★ Trouble free automatic bar-feed. Pneumatic or hand locking for collets and chucks. Rapid interchange between bar and chuck work. Choice of 3 speed ranges, each with 12 speeds (6 if no gearbox). 6 power-feed rates to turret with same feed-shaft speed.

REASONABLE DELIVERIES

TIMBRELL & WRIGHT LTD.

SLANEY STREET . BIRMINGHAM 4.

Telephones: Colmore 4523-4. Central 1201.
Telegrams: "Revolving" Birmingham.



TWO OF THE

Reglo

RANGE THAT ARE
ALWAYS IN DEMAND

RT. 140
SINGLE 40 WATT 4FT TROUGH
LIST: £5. 12. 6.

RT. 240
TWIN 40 WATT 4FT TROUGH
LIST: £8. 2. 6.

AS USED ON ALL
GOVERNMENT
TRADING ESTATES
AND BY LEADING
HOSPITALS &
INDUSTRIALISTS

C-W-C EQUIPMENT LTD. The Manufacturers of Fluorescent Lighting Fittings
66 VICTORIA ST., LONDON, S.W.1 Tel. VICTORIA 4524 5

*For
Machine Tool
Control—*

Provided with undervoltage release
and three hand resetting overcurrent
releases. Enclosed in dust-protecting
case and supplied with pushbuttons in
lid or for remote operation.



D

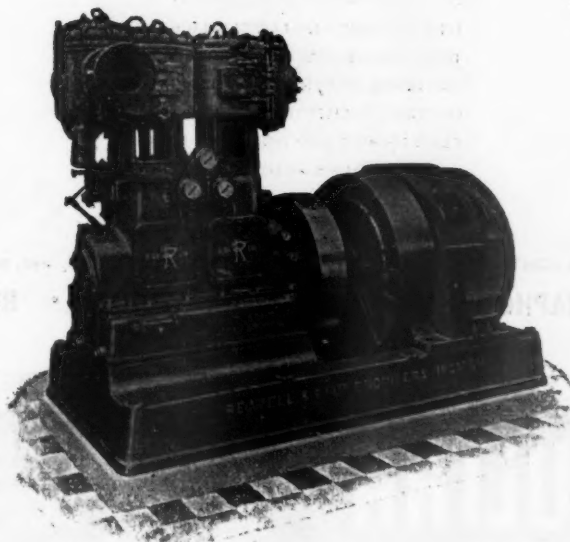
**A-C DIRECT-SWITCHING
CONTACTOR
STARTER --**

DONOVANS

THE DONOVAN ELECTRICAL CO LTD BIRMINGHAM, 9
ELECTRICAL ENGINEERS AND STOCKHOLDERS.
Phone - STERCHORD 2277 (PB.X.) GRANT-DONOVAN, BIRMINGHAM

*The Size 1 illustrated is
suitable for Squirrel Cage
Motors up to 7½ h.p.*

AIR COMPRESSORS



We have standard types for all capacities and pressures and can supply the most efficient and reliable machine for any duty.

REAVELL & CO. LTD. - IPSWICH

Telegrams: "Reavell, Ipswich."

Telephone Nos. 2124-5-6

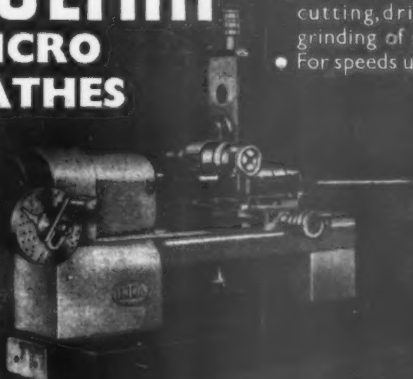
"RECENT ACHIEVEMENTS"

OPTICAL TRANSMISSION INSTRUMENT.
LENS GRINDING AND LAPPING MACHINERY.
THIRD DIMENSIONAL MECHANISM.
ELECTRONIC SELECTING AND SIZING MACHINE.
PRECISION MAGSLIP TRANSMISSION.
GLASS ETCHING AND ENGRAVING MACHINE.
JIGS AND FIXTURES AD LIB.

send your enquiries for
LIGHT PRECISION MACHINERY, JIGS, FIXTURES, etc. to
TECNAPHOT LIMITED • TECNA WORKS • RUGBY
TEL. : RUGBY 4145

PULTRA

MICRO LATHES



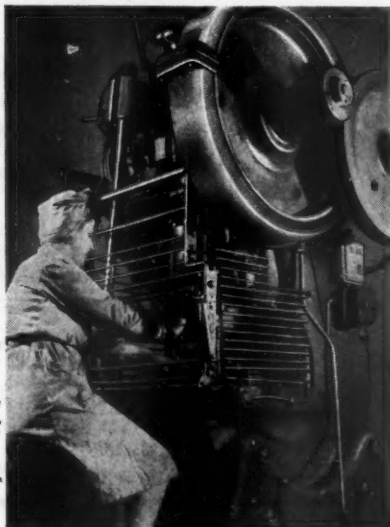
- 50 mm. and 90 mm. centre height.
- Very wide range of accessories.
- Ideal for turning, polishing, saw cutting, drilling, milling and grinding of small parts.
- For speeds up to 12,000 r.p.m.



WRITE
FOR CATALOGUE

YOU CAN TURN A HAIR ON A PULTRA LATHE

Photograph by kind permission of CHAS. TWIGG & CO. LTD, Birmingham



Pressing News

H.M.E. Power Presses are achieving dependable output among an ever widening circle of satisfied users.

Our Technical Department is at your service to advise on the best model for your requirements from our range of 3—300 tons capacity.

HORDERN, MASON & EDWARDS LTD

WOODLANDS FARM ROAD,
Telephone : Ashfield 1104 (7 lines)



PYPE HAYES, BIRMINGHAM 24
Telegrams : Alchemmee, Birmingham

"MARLCO" KEYWAY BROACHES



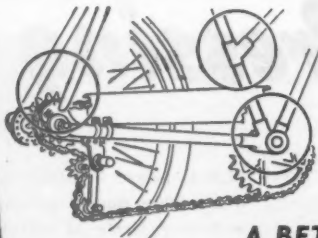
Range $\frac{1}{8}$ " to $\frac{1}{2}$ ". Made of 18 per cent H.S. Steel and ground all over. Will cut parallel or taper keyways to specification B.S.S. A20, or non-standard. Offered in sets or individually.

Full particulars on request.

W. H. MARLEY & CO. LTD.

*S. Tools Dept., New Southgate Works,
105, High Road, London, N.11*

Telephone : ENTerprise 5234



A BETTER CYCLE
... thanks to **ELECTRONICS**

New methods of brazing by induction heating are revolutionising many branches of engineering. Brazing times have been reduced from minutes to seconds—a cleaner and better joint made. This is only one of the many ways in which reduced costs and greater efficiency can now be achieved with Airmec Electronic Heat Generators. Probably your product and output could be helped by electronics—write now for a copy of List G.A. 157.

AIRMEC

ELECTRONIC HEAT GENERATORS

AIRMEC LABORATORIES LIMITED, Cressex, High Wycombe, Bucks.
Telephone : High Wycombe 2060.

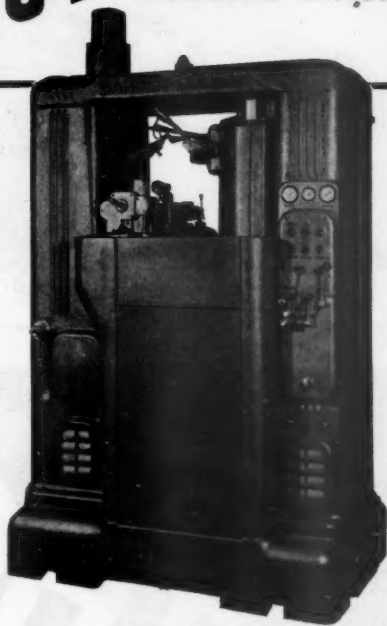
Manufacturers of all types of industrial electronic equipment and test gear



Introducing the

BARBER-COLMAN NO 8-10 Vertical HOBBING MACHINE

This machine, which has a capacity of 8" diameter by 10" long and an outstandingly rugged construction, is designed for high speed production of spur or helical gears or splines. Rigid arch-type casting, extra long vertical ways, which align the work slide, heavy short-coupled drive shafts and broad faced helical and bevel gearing, provide smooth powerful operation and minimum distortion of machine members even under the heaviest cuts. This extra-heavy structure plus accurate mounting of the hob on the taper hob spindle, ensures consistent accuracy while the machine maintains a high output, even through day-in day-out operation. Effortless control is provided by the handy centralised panel, from which a lever sets in motion the machine's semi-automatic cycle. A simple selector regulates the 8—10 to either climb or conventional cutting. Increases in hob life ranging up to 50% are achieved by fitting the new Barber-Colman 8—10 Hob Shifter.



For details write to :

BARBER & COLMAN LTD., MARSLAND RD., BROOKLANDS, MANCHESTER
 Telephone : SALE 2277 (3 lines) Telegrams : "BARCOL" SALE

PRECISION (M&W) HAND TOOLS




MANUFACTURED BY
MOORE & WRIGHT (SHEFFIELD) LTD
 AT BRITAIN'S TOOL FACTORY

MEMBERS OF THE GAUGE AND TOOL MAKERS' ASSOCIATION

For Gauges, Taps and
 all Precision Tools.
 Ensures maximum
 degree of accuracy
 after hardening.

**NON-SHRINK
 PITHO
 OIL-HARDENING
 STEEL**



Steel
 Makers
 since
 1776.

SANDERSON & BROTHERS & NEWBOULD LTD SHEFFIELD ENGLAND

Each cleaning problem studied individually

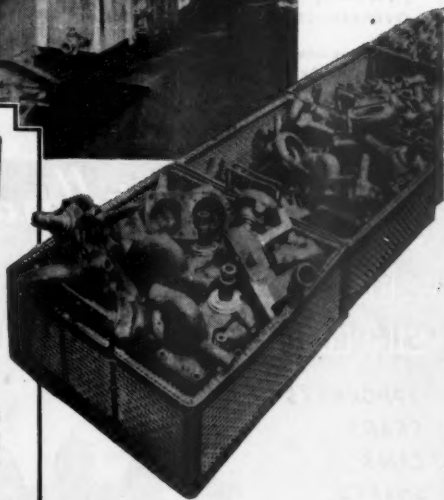


Bratby

**INDUSTRIAL
CLEANING
MACHINES**

This illustration shows a machine cleaning crank cases in the production line.

It is equally capable of cleaning small parts in baskets.



Photographs by courtesy of "Machinery."

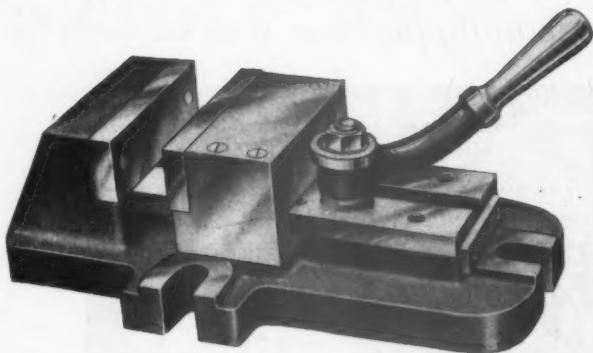
Sole Agents for Great Britain :

GEO. H. HALES MACHINE TOOL CO. LTD., Victor House, 1, Baker St., LONDON, W.1

Designed and manufactured by :

BRATBY & HINCHLIFFE LTD., SANDFORD STREET, ANCOATS, MANCHESTER 4

CAM ACTION VICE FOR PRODUCTION.



JAWS — 4½" x 1½" OPENING — 3½"
OVERALL — 12" x 8" WEIGHT — 36 lbs.

JAWS are interchangeable and soft jaws for machining to component shape are available.

EX STOCK!!

FROM

C. H. JOYCE LTD.
 40 MONKTON ST., LONDON, S.E.11

Perfect Hardening

• ABRASION RESISTANCE • NO SCALING
 • SIMPLIFIED MACHINING • LOW DISTORTION

SPROCKETS

GEARS

CAMS

SHAFTS

ROCKERS

VALVES

RAMS

ROLLERS

by shorter process!

Flame Hardeners

LIMITED

SHORTER WORKS.

BAILEY LANE,

SHEFFIELD.1.

TELEPHONE: SHEFFIELD 21627

TO PRODUCTION ENGINEERS

and especially those who are expected to boost output on semi-obsolete machines.

FLOOR-TO-FLOOR EFFICIENCY.

A semi-obsolete machine can produce something akin to the output of a modern machine by the use of up-to-date air clamping equipment.

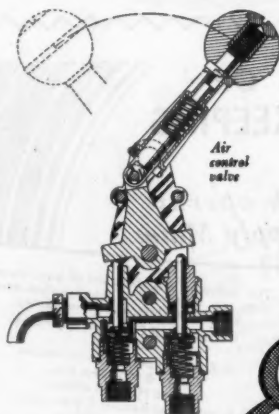
Example :—

(A) Using hand-clamping method.

Handling time	30 secs.	} per unit.
Machining time	30 secs.	
= 1 unit per minute.		

(B) Using Enots Air Clamping Equipment.

Handling time	10 secs.	} per unit.
Machining time	30 secs.	
= 1 unit per 40 secs.		



Now, don't say "my work's different!" You can't really say till you've had a talk with us. And please don't put the matter aside. If you don't need air clamp equipment we shall soon tell you. If you do need it — you need it *now*. Let's get together on this.



BENTON AND STONE LIMITED · BIRMINGHAM

JOHANSSON taps

ARE ALL THREAD GROUND
AND PRODUCE FINE THREADS

C.E. JOHANSSON LTD.
PRECISION TOOLS AND INSTRUMENTS

PRECISION ENGINEERING WORKS, WATLING ST., DUNSTABLE TEL: DUNSTABLE 422

DH3

THE PIONEERS OF ELECTRICAL TIMEKEEPING

*Electric Clocks which operate
independently of the Supply Mains*

The Synchronome Electrical Impulse Clock was first produced in 1895. Since then hundreds of Factories, Educational Establishments and Municipal Establishments have been fitted with the Synchronome System of Timekeeping. It is independent of the Mains Supply and one Master Clock will control any number of subsidiary dials, Employees time recording machines, Watchmans Tell-tale Clocks, and start and cease work signals.

Write for further information and particulars of purchase outright or rental scheme

The following is a short list of businesses that are fitted with the Synchronome System of Electrical Timekeeping:
Institution of Electrical Engineers, London.

B.E.A., Kingston Power Station.
Cables & Wireless Ltd.,
Electra House, London.
British Broadcasting Corporation,
Broadcasting House,
Portland Place, London, W.1.
State Hydro-Electric Department,
New Zealand.

Grid Metering & Meters Act.
Standard Master Clocks a speciality.

The
SYNCHRONOME CO., LTD.

Abbey Electric Clock Works,

ALPERTON · MIDDLESEX · Phone : WEMbley 3643

Holders of the World's Record for Timekeeping since 1925

422

DH3

FIRTH BROWN

YOUR PROTECTION FROM TROUBLE

Uncertainty about steels is one of the designer's bugbears. The doubts about inclusions—the doubts about the regularity of physical and mechanical properties—fears about transverse and longitudinal fatigue resistance and so on. The specifying of Firth Brown Steels at once removes such uncertainty, such doubts and fears. In these steels you can rely on perfect homogeneity, cleanliness and the regularity of stated properties.


ALLOY STEELS

ALLOY STEEL MAKERS TO ENGINEERS LARGE OR SMALL THE WORLD OVER

Issued by Thos. Firth & John Brown Ltd.

SHEFFIELD

THE SCREW WITH A *Head* START!



Each Phillips Screw or Bolt has a precision forged head recess accurately fitted by the matching driver bit. The recess is a special four-winged shape with tapering sides, which automatically centres, grips and aligns the driver, and is proportioned to allow maximum driving torque for each size of Bolt or Screw. Phillips Screws and Bolts are ideal for power driving. The heads do not burr, costly driver skids are eliminated and assembly is faster. They are made with Round, Mush, Countersunk, Oval or Fillister Heads in all sizes from 6 B.A. up to 1" diameter by LINREAD LTD., Sterling Works, Cox Street, Birmingham, 3, who will be pleased to forward further information on request.

**Linread
Phillips Screws**

LINREAD LIMITED · COX STREET · BIRMINGHAM 3

and at...

CLIFTON HOUSE, EUSTON ROAD, LONDON, N.W.1

When writing, please mention department L.P.E.

FOR RELIABLE METAL CASTINGS**SPECIFY**

REGISTERED TRADE MARK

The Technically Controlled Castings Group
18 ADAM STREET, LONDON, W.C.2.

LAKE & ELLIOT, LTD., BRAINTREE · SHOTTON BROS., LTD., OLDBURY
S. RUSSELL & SONS, LTD., LEICESTER · HENRY WALLWORK & CO., LTD., MANCHESTER
ALEX. SHANKS & SON, LTD., ARBROATH · JOHN WILLIAMS & SONS (CARDIFF) LTD

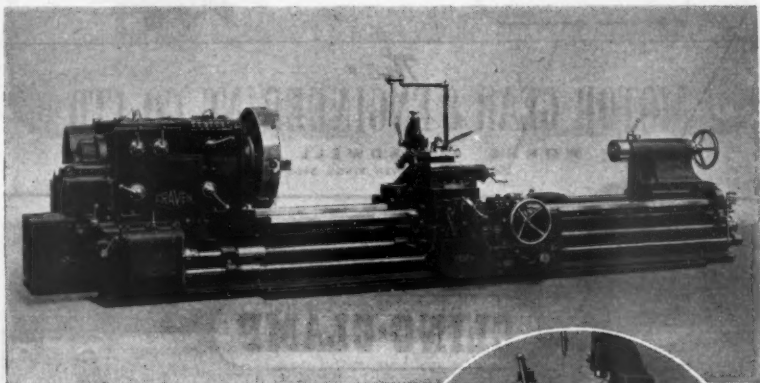
**PRESS TOOLS****MOULDS****AND JIGS****Universal Tools LTD**

TRAMWAY PATH
MITCHAM
SURREY

Phone : Mitcham 1624-5-6.

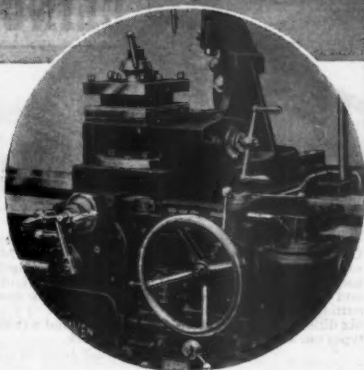
CRAVEN *High Speed* **HEAVY DUTY LATHES**

OF ALL TYPES FROM 16" TO 100" CENTRES



"CRAVEN" 16" CENTRES SUPER HIGH SPEED LATHE

A high-production lathe for the modern cutting tool. Spindle speeds range from 4 to 400 r.p.m. and the headstock is fitted through-out with ball and roller journals. Screwcutting is standard, coning by gearing and taper turning by tangent bar are supplied to order.



CRAVEN BROTHERS (Manchester) LIMITED
VAUXHALL WORKS REDDISH STOCKPORT

GEARS FOR ALL APPLICATIONS

SPURS · SPIRALS
 SPROCKETS
 WORM WHEELS
 WORMS · HELICALS
 STRAIGHT BEVELS
 SPIRAL BEVELS



The MOTOR GEAR & ENGINEERING CO. LTD.

ESSEX WORKS · CHADWELL HEATH · ESSEX

Telephone · SEVEN KINGS 3406 (4 LINES)

A Clamp with Unlimited Application in Your Plant

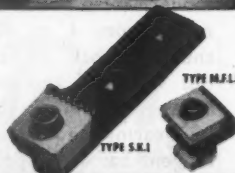
CLINO-CLAMP



Unproductive times can be considerably shortened by the use of CLINO-CLAMP standard clamps on all types of Machine Tools. They supersede the improvised packing pieces and holding down fixtures so often used in the machine shop. They are compact, rigid, give a positive grip and owing to very low over-all height they allow maximum clearance for cutting tools.

Six different types of clamp are available, and a combination of different types can be used for irregular shaped work.

A fully descriptive folder will be sent on request.



ADAM

Machine Tool Company Limited

ACME WORKS · WAVERLEY ROAD · ST. ALBANS · HERTS

Telephone · N. 3124

Agents · Messrs. J. & A. ...



... an attractive necessity that encloses the miniature radio set. This is just one of the many Injection moulding problems tackled by Punfield & Barstow for the Radio manufacturer. Yet ALL trades have their moulding problems, so why not get in touch with us?—"The more difficult it is—The more we like it." Quotation by return post.

SOME OF OUR SATISFIED CLIENTS

Aladdin Industries Ltd.
Champion Electric Corporation.
E. K. Cole Ltd.
Crystal Products Ltd.
Decca Navigator Co. Ltd.
General Electric Co. Ltd.
Lightning Fasteners Ltd.
Newey Bros. Ltd.
Plessey Co. Ltd.
Pye Ltd.
Reeves & Sons Ltd.
Simmonds Aerocessories Ltd.
Slazengers Ltd.
S. Smith & Sons (England) Ltd.
Wilmot-Breedon Ltd.
Yard-o-led Pencil Co. Ltd.

You can rely on

PUNFIELD & BARSTOW
(Mouldings) Ltd.



BASIL WORKS,
WESTMORELAND ROAD, QUEENSBURY, LONDON, N.W.2
'Phone : COLindale 7160 & 7956. 'Grams : " Punfibars, Hyde, London."

FOR INJECTION MOULDINGS

INDEX TO ADVERTISEMENTS

	Page		Page
Acheson Colloids, Ltd.	xxiii	Keelavite Rotary Pumps & Motors, Ltd.	vi
Adam Machine Tool Co., Ltd.	lxiv	King, Geo. W. Ltd.	—
Airmec Laboratories, Ltd.	lii	Lang, John & Sons, Ltd.	v
Ajax Machine Tool Co. Ltd.	xxiv	Lewis & Tylor, Ltd.	lx
Arnott & Harrison, Ltd.	—	Linread, Ltd.	lxi
Asquith, Wm. Ltd.	—	Lloyd, Richard Ltd.	—
Automatic Coil Winder and Electrical Equip- ment Co., Ltd.	xlü	Lund, John Ltd....	xxii
Barber & Colman, Ltd.	liii	Marley, W. H. & Co. Ltd.	lii
Benton & Stone, Ltd....	lvii	Ministry of Fuel and Power	xxvi
Birlec, Ltd.	—	Mollart Engineering Co., Ltd.	—
Birmingham Aluminium Casting (1903) Co. Ltd.	iii	Moore & Wright (Sheffield) Ltd.	liv
Bratby & Hinchliffe, Ltd.	lv	Morgan, George, Ltd.	—
British Steel Founders' Association	—	Motor Gear & Engineering Co., Ltd.	lxiv
B.S.A. Tools Ltd.	xxxiii	McKechnie Bros. Ltd.	—
C.W.C. Equipment Ltd.	xlvi	Newall, A. P. & Co., Ltd.	vii
Camerer Cuss & Co., Ltd.	—	Newall Group Sales Ltd.	z
Catmur Machine Tool Corporation, Ltd.	xxiv	Norton Grinding Wheel Co., Ltd.	—
Churchill, Charles & Co., Ltd.	xxix	Parkinson, J. & Son	—
Cincinnati Milling Machines, Ltd.	xxix	Parsons Chain Co. Ltd.	xxi
Climax Rock Drill and Engineering Works, Ltd.	xxx	Perry Barr Metal Co. Ltd.	—
Cohan Geo. Sons & Co. Ltd.	xxvii	Pitter Gauge & Precision Tool Co. Ltd.	—
Covenry Gauge & Tool Co., Ltd.	xviii	Protolite, Ltd.	—
Craven Bros. (Manchester) Ltd.	lxiii	Pryor, Edward & Son, Ltd.	—
Croft Engineering Ltd.	—	Pultra, Ltd.	l
Crompton Parkinson, Ltd.	xiv	Punfield & Barstow (Mouldings) Ltd.	lxv
Dawson Bros., Ltd.	xlvi	Quasi-Arc Co. Ltd., The	xv
Dean, Smith & Grace, Ltd.	xxv	Randalrak, Ltd.	—
Desoutter Bros. Ltd.	—	Ratcliffe Tool Co., Ltd.	—
Donovan Electrical Co., Ltd.	xlvi	Reavell & Co., Ltd.	xliz
Drummond Bros., Ltd.	xix	Remington Rand Ltd.	—
Duckham, Alexander, & Co., Ltd.	—	Riley, Robert, Ltd.	—
Electro Dynamic Construction Co., Ltd.	—	Sanderson Bros. & Newbould, Ltd.	liv
Elliott, B. & Co. Ltd.	—	Scottish Aviation Ltd.	—
E.M.B. Co., Ltd.	xlili	Sheet Metal Technicians, Ltd....	—
Exors. of James Mills, Ltd.	xii	Sheffield Twist Drill & Steel Co., Ltd., The...	—
Fascol, Ltd.	xi	Smart & Brown (Machine Tools) Ltd.	—
Firth, Brown Tools Ltd.	lix	Sterling Metals Ltd.	—
Flame Hardeners Ltd.	lvi	Sunbeam Anti-Corrosives, Ltd.	lx
Fletcher Miller, Ltd.	xl	Sundstrand Pneumatic Sanders (Britain) Ltd.	—
Gill, Samuel & Sons (Engineers) Ltd.	—	Swift, Geo. & Son, Ltd.	xxvi
Gledhill-Brook Time Recorders Ltd.	—	Synchronome Co. Ltd.	lviii
Glover, J., & Sons, Ltd.	xv	Talbot-Stead Tube Co. Ltd.	—
G.P.A. Tools & Gauges, Ltd.	xvi	Taylor & Jones, Ltd.	xxv
Guylee, Frank & Son, Ltd.	Inside Back Cover	Technically Controlled Castings Group, The	lxii
Harris, John, Tools Ltd.	xx	Tecnaphot, Ltd....	l
Headland, Thos. P. Ltd.	—	Timbrell & Wright, Ltd.	xlvi
Hendry, James Ltd.	xli	Towler Bros. (Patents) Ltd.	—
Herbert, Alfred Ltd.	xlii, xlv	Triefus & Co. Ltd.	Inside Front Cover
High Duty Alloys, Ltd.	—	Tyne Truck & Trolley Co. Ltd.	—
Hilger & Watts, Ltd.	—	Unbrako Socket Screw Co., Ltd.	xvii
Holman Bros. Ltd.	Back Cover	Universal Tools, Ltd.	lxii
Hoover, Ltd.	viii	Vaughan, Edgar & Co., Ltd.	—
Hordern, Mason & Edwards, Ltd.	li	Ward, H. W. & Co., Ltd.	iv
Hughes, F. A. & Co., Ltd.	ix	Ward, Thos. W., Ltd.	xxvii
Imperial Smelting Corporation, Ltd.	xxviii	Wickman, A. C. Ltd.	xlii, xxxi
Johansson, C. E. Ltd.	lviii	Williams & James (Engineers) Ltd.	—
Joyce, C. H., Ltd.	lvi	Wolverhampton Die Casting Co., Ltd.	xxviii
		Zinc Alloy Die Casters Association	xxii

Page
vi
—
v
lx
lxi
—
xxxii
lii
xxvi
—
liv
—
lxiv
—
vii
x
—
—
xxi
—
—
—
l
lxv
xv
—
—
xlix
—
—
liv
—
—
—
—
lx
—
xxxvi
lviii
—
xxv
lxii
l
xlvii
—
Cover
—
xvii
lxii
—
iv
xxxvii
xxxi
—
xxviii
xxii

'ARCHER' SLEEVES & SOCKETS

Specialised Production.

PRODUCED IN TWO QUALITIES.

ARCHER SUPER QUALITY Sleeves and Sockets are hardened all over; ground internally and externally, and are of exceptionally high quality. They have a long life of accuracy and concentricity.



THESE SUPER SLEEVES being hardened, prevents bruises and burrs from rough shop usage, and thereby protects machine spindle bores from damage. The extra cost of these hardened high-grade Sleeves and Sockets is very soon paid for by the savings effected.

ARCHER STANDARD QUALITY Sleeves and Sockets meet the demand for a high class sleeve at a moderate cost. Both the internal and external taper are guaranteed to standard Morse gauges. The tangs and slots are correct in dimensions and centralised, thereby avoiding tang binding and broken tangs.

THESE STANDARD Sleeves and Sockets are toughened by oil-heat treatment, and stand up to shop usage much better than the cheaper soft sleeves.



BUY BRITISH SLEEVES — ASK FOR LIST 45

FRANK GUYLEE & SON

'ARCHER' TOOL WORKS. *Ltd.*
MILLHOUSES · SHEFFIELD. 8

Loco Rod Grinder



This is a specialised tool included in the Holman Rotogrind series of pneumatic grinders. Designed primarily for grinding rods of locomotives it has a wide range of other applications. The standard wheel is 9" wide and is therefore very suitable for dressing or smoothing off any wide surface. As an alternative a 6" wheel can be fitted. The motor is the vane type fitted as standard to all Holman Rotogrinds. Blade pressure on the cylinder is controlled by a patented system that increases torque and power, and reduces wear to a minimum. The tool is easily handled and controlled by a hand-operated throttle. It is simple to maintain and needs very little servicing. May we send full details?

Holman PNEUMATIC TOOLS

The first name for lasting service

HOLMAN BROS LTD · CAMBORNE · ENGLAND

T.E.W.

TP 36

All communications regarding advertisements should be addressed to the Advertising Managers, T. G. Scott & Son, Ltd., Talbot House, 9, Arundel Street, London, W.C.2. Phone: Temple Bar 1942. Printed by Maxwell, Love & Co., Ltd., Bradley's Buildings, White Lion Street, London, N.1.

S

D
P 36

2.
2.
1.